

**PRIVATE HIGHER EDUCATIONAL INSTITUTION
"INTERNATIONAL ACADEMY OF ECOLOGY AND
MEDICINE"**

Department of Fundamental Disciplines

WORKING PROGRAM OF EDUCATIONAL DISCIPLINE

"Physiology"

LEVEL OF HIGHER EDUCATION Second (master's) level
DEGREE OF HIGHER EDUCATION Master's degree
BRANCH OF KNOWLEDGE 22 Healthcare
SPECIALTY 222 Medicine

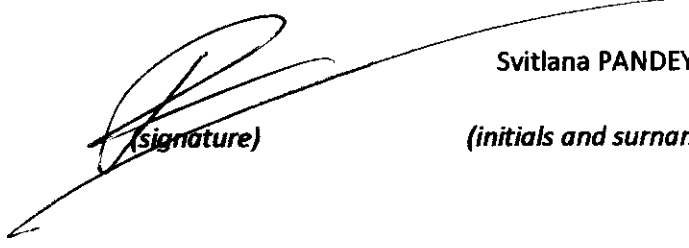
Reviewed and approved
at the meeting of the Academic Council
Protocol No. 1, dated August 01, 2016

Kiev 2016

Working program of education discipline Physiology for the preparation of students of higher education of the second (master's) level of higher education in specialty 222 Medicine.

Agreed

The vice-rector

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(signature)

Svitlana PANDEY

(initials and surname)

Introduction

The program in the academic discipline "Physiology" is compiled in accordance with the educational and professional program for training specialists of the second (master's) level of specialty 222 Medicine, fields of knowledge 22 Health care, the Law of Ukraine "On Higher Education" dated 07/01/2014 No. 1556 - VII (Article 13, Clause 7), the provision "On the organization of the educational process at the International Academy of Ecology and Medicine", methodological recommendations approved by the Central Methodical Office of Higher Medical Education of the Ministry of Health of Ukraine regarding the development of programs of educational disciplines in accordance with industry standards of higher education education The discipline "Physiology" belongs to the section of General training of the training plan for applicants of higher education of the second educational (master's) level.

Description of the academic discipline

Name of indicators	Field of knowledge, direction of training, educational and qualification level	Characteristics of the academic discipline	
		full-time education	
The number of credits is 10.0	Branch of knowledge: 22 Health care		
Modules - 2	Specialty: 222 Medicine	Year of preparation:	
There are 17 content modules		2nd	
		Semester	
The total number of hours is 300		III	And V th
	Educational level: master's degree	Lectures	
		20 h.	30 h.
		Practical	
		60 h.	70 h.
		Independent (individual) work	
		55 h.	65 h.
		Type of control: Current and final modular control, exam	

The subject of study of the academic discipline is the regularities of functions and processes in the whole organism and its parts (systems, organs, tissues, cells), the identification of causes, mechanisms and regularities of the vital activity of the organism at various stages of onto- and phylogeny in interaction with the environment in the dynamics of life processes.

Interdisciplinary connections : the academic discipline is based on the students' study of medical biology, histology, cytology and embryology, Latin language, ethics, philosophy, ecology, medical and biological physics, medical chemistry, biological and bioorganic chemistry and is integrated with these disciplines; lays the foundations for students to study pathophysiology, pathomorphology, operative surgery and topographic anatomy, deontology and propaedeutics of clinical disciplines, which involves the integration of teaching with these disciplines and the formation of skills to apply knowledge of physiology in the process of further education and professional activity; lays the foundations of a healthy lifestyle and prevention of structural and functional impairment in life.

1. PURPOSE AND OBJECTIVES OF THE EDUCATIONAL DISCIPLINE

1.1. The purpose of teaching the academic discipline "Physiology" stems from the goals of the educational and professional training program for students of the second educational (master's) level of higher education and is determined by the content of the system knowledge and skills that a doctor must master. The knowledge that students receive from the study discipline "Physiology" is basic for the block of disciplines that provide natural-scientific and professional-practical training.

1.2. The main ones with the objectives of studying the discipline " Physiology " are:

- the disclosure of human physiology as a science of the vital activity of the organism in its interaction with the external environment. Human physiology is an important theoretical and biological basis of medical knowledge aimed at supporting human health and active activities

1.3 . Competences and learning outcomes, the formation of which helps " Physiology " discipline .

According to the requirements of the Standard of Higher Education, the discipline " Physiology " ensures that students acquire the following **competencies:**

Integral:

- the ability to interpret the general biological regularities underlying human life processes.

From the agalina:

- ability to abstract thinking, analysis and synthesis ;
- ability to learn and master modern knowledge ;
- ability to apply knowledge in practical situations ;
- knowledge and understanding of the subject area and understanding of professional activity ;
- the ability to make informed decisions ;
- skills in using information and communication technologies ;
- in certainty and perseverance regarding the assigned tasks and assumed responsibilities.

With special (professional, subject) :

- from the principles of construction and functioning of the body's effector tissues ;
- on the mechanisms of neurohumoral regulation of body functions ;
- from the main forms of congenital and acquired human and animal behavior ;
- learning the basic principles of research application human physiology .

Matrix of competences

No	Competence	Knowledge	Skill	Communication	Autonomy and responsibility
Integral competence					
The ability to solve typical and complex specialized tasks and practical problems in professional activities in the field of health care, or in the process of learning, which involves conducting research and/or making innovations and is characterized by the complexity and uncertainty of conditions and requirements.					
General competences					
1	Ability to apply knowledge of human physiology in practical situations	Have specialized conceptual knowledge acquired in the learning process	To be able to solve complex tasks and problems that arise in professional activity	Clear and unambiguous presentation of one's own conclusions, knowledge and explanations, which justify them to specialists and non-specialists	Be responsible for making decisions in difficult conditions

2	Knowledge and understanding of the subject area of human physiology	Have in-depth knowledge of the structure of professional activity	To be able to carry out professional activities that require updating and integration of knowledge	The ability to effectively form a communication strategy in professional activities	To be responsible for professional development, the ability for further professional training with a high level of autonomy
3	The ability to choose a communication strategy, the ability to work in a team, interpersonal skills	Know the tactics and communication strategies, laws and methods of communicative behavior	Be able to choose communication methods and strategies to ensure effective teamwork	Use communication strategies and interpersonal skills	To be responsible for the choice and tactics of the method of communication
4	Ability to abstract thinking, analysis and synthesis, ability to learn and be modernly educated	Know methods of analysis, synthesis and further modern education	To be able to analyze information, to make informed decisions, to be able to obtain modern knowledge	Establish appropriate connections to achieve goals	To be responsible for the timely acquisition of modern knowledge
5	Skills in using information and communication technologies	Have deep knowledge in the field of information and communication technologies used in professional activities	To be able to use information and communication technologies in a professional field that requires updating and integration of knowledge.	Use information and communication technologies in professional activities	To be responsible for the development of professional knowledge and skills.
6	The ability to evaluate and ensure the quality of the work performed	Know the methods of evaluating performance quality indicators	Be able to ensure quality performance of works	Establish connections to ensure quality performance of works	Be responsible for quality performance works
7	Determination and persistence in relation to assigned tasks and assumed responsibilities	Know the responsibilities and ways of performing assigned tasks	To be able to determine the goal and task, to be persistent and conscientious in the performance of duties	Establish interpersonal relationships for effective performance of tasks and duties	To be responsible for high-quality performance of assigned tasks

Special (professional, subject) competences					
1	Knowledge principles buildings and functioning of the body's effector tissues	Know the course of the main metabolic pathways body for physiological conditions, directions of their hormonal regulation and the main causes of their hereditary and acquired violations	Describe the mechanisms of functioning of physiological systems human body and their regulation	Clear and unambiguous presentation of one's own conclusions, knowledge and explanations regarding this issue	Be responsible for quality completed work
2	Knowledge of mechanisms of neurohumoral regulation of body functions.	Know physiological underlying mechanisms functioning gastrointestinal organs tract, kidneys, nervous and muscular systems, connective tissue, endocrine glands	To know is right select adequate methods for study physiological processes in body a person	Characterize the peculiarities of the flow of physiological functions of various organs	Be responsible for making a decision at independent selection of skills studying literature, dedicated to human physiology.
3	Knowledge of the basic forms of congenital and acquired human and animal behavior	Have specialized knowledge about a person, his organs and systems	To be able to use methods of statistical analysis of experimental results	Clear and unambiguous presentation of one's own conclusions, knowledge and explanations regarding this issue	Be responsible for making a decision about evaluation of the results of experimental investigations
4	Knowledge of the basic principles of research application human physiology	To know the role and features of the application of research with human physiology	Carry out calculations of physiological indicators	Establish connections for discussion when choosing physiological indicators	Be responsible for making a decision about evaluation of the results of laboratory studies

Learning outcomes:

Integrative final learning outcomes, the formation of which is facilitated by the educational discipline:

- " Physiology " as an educational discipline lays the foundation for the formation of the following program learning outcomes in the future in accordance with the Standard of Higher Education of Ukraine for training specialists of the second (master's) level of specialty 222 Medicine:
 1. Establish the most likely or syndromic diagnosis of the disease (according to list 2) and prescribe laboratory and/or instrumental examination of the patient .
 2. Plan measures to prevent the spread of infectious diseases, carry out detection and early diagnosis of infectious diseases (according to list 2).
 3. Identify risk factors for the occurrence and course of the disease.
 4. Identify negative environmental factors. Assess the impact of socio-economic and biological determinants on the health of the individual, family, and population.
 5. Follow a healthy lifestyle, use means of self-regulation and self-control.

Learning outcomes for the discipline : After completing the study of the discipline " Physiology ", students must

to know :

- Excitation processes and their indicators in excitable structures.
- Basic quantitative parameters describing the capacity of particular systems and organs, including the range of norms and demographic factors influencing the value of these parameters.
- Methods of intercellular communication, as well as between the cell and the extracellular matrix, and signal pathways in the cell, and examples of disorders in these processes leading to the development of cancer and other diseases.
- Mechanisms of propagation of excitation along nerves, in the central nervous system and in effector systems.
- Knows and understands the body's water and electrolyte balance
- Acid-base balance and buffer mechanism, and their importance in systemic homeostasis
- General principles of regulation of body functions and its specific mechanisms.
- Functional systems of the body, their role in ensuring adaptive reactions of the body.
- Mechanisms of functioning of individual organs and systems.
- Mechanisms of regulation of organs and systems.
- Normal indicators of the functioning of the human body.
- Development, structure and functions of the human body in normal and pathological conditions;

- Relationship between factors disturbing the balance of biological processes and physiological and pathophysiological changes.
- The mechanism of the body's aging.
- Activity and mechanisms of regulation of all organs and systems of the human body, including the cardiovascular system, respiratory system, digestive system, urinary tract and skin layers, and the interrelations existing between them.

be able:

- To evaluate indicators of fractional probing of the stomach.
- Evaluate indicators of fractional probing of the duodenum.
- Determine the content of hemoglobin in the blood.
- To determine the group affiliation of blood in the ABO and Rh - factor systems.
- Evaluate the general blood test.
- Evaluate the leukocyte blood formula.
- Measure blood pressure using the Korotkov method.
- Analyze a normal electrocardiogram.
- Perform a phase analysis of the cardiac cycle based on a polycardiogram.
- Analyze the echocardiogram.
- Identify medical problems and prioritize medical management.
- Plan own learning activities and constantly learn in order to update own knowledge.
- Perform simple functional tests assessing the human body as a stable regulation system (stress tests, exercise tests) and interpret numerical data on basic physiological variables
- Use databases, including online databases, and search for the necessary information using the available tools.
- Indicate the relationship between factors disturbing the balance of biological processes and physiological and pathophysiological changes.
- Identify sources of electrical signals in the body.
- Use digital libraries.
- Provide expert knowledge through simple IT techniques of knowledge representation such as a block diagram or a rule database.
- Use various types of computer simulators and e-learning tools for educational purposes, with particular emphasis on virtual patients.
- Analyze static indicators of external breathing.
- Analyze the spirogram (estimation of static and dynamic indicators of external breathing) .

is ready to:

- use objective sources of information;

- formulate conclusions from own measurements or observations.

2. INFORMATION VOLUME OF THE EDUCATIONAL DISCIPLINE

300 hours of 10.0 ECTS credits are allocated to the study of the academic discipline, including lectures 50 hours, practical (seminar classes) 130 hours, independent work 120 hours. Normative discipline .

The discipline program is structured into 2 modules , which include blocks of content modules:

Module 1. "General physiology and higher integrative functions."

Content modules:

- 1. Introduction to physiology.*
- 2. Physiology of excitatory structures .*
- 3. Nervous regulation of body functions.*
- 4. Physiology of sensory systems.*
- 5. The role of the central nervous system (CNS) in the regulation of motor functions.*
- 6. The role of the autonomic nervous system in the regulation of visceral functions.*
- 7. Humoral regulation and the role of endocrine glands in the regulation of visceral functions.*
- 8. Physiological bases of behavior. Physiology of emotions.*
- 9. Cognitive functions.*
- 10. Physiology of work and sports.*

Module 2. "Physiology of visceral systems"

Content modules:

- 11. Blood system.*
- 12. Circulatory system.*
- 13. Respiratory system.*
- 14. Energy exchange.*
- 15. Thermoregulation.*
- 16. Digestive system.*
- 17. Allocation system.*

Module 1. "General physiology and higher integrative functions"

Content module 1. Introduction to physiology

Tasks:

- *To teach the student the rules of setting the problem*
- *Explain the physiological basis of the methods of studying body functions in experiments on animals and in the study of human functions in various physiological states*
- *Analyze the stages of physiology as a fundamental discipline in medicine and the contribution of individual scientists at each stage .*

Topic 1. Subject and tasks of physiology. Methods of physiological research

Physiology is a science that studies the objective regularities of the functions of the human body and its structures (systems, organs, tissues, cells) in their unity and interaction of the body with the external environment.

Physiology as a scientific basis of medicine about body functions, ways of maintaining health and working capacity. The value of physiology in training a doctor.

Physiological research methods: observation, experiments, modeling.

Levels of the structure of the human body and its functions. The unity of the organism and the external environment.

Physiological characteristics of functions, their parameters. Relationship between structure and function. Age and sex characteristics of functions.

Functions of cells, tissues, organs, physiological systems of the body.

Homeostasis.

Topic 2. The main stages of the development of physiology.

Characteristics of the development of physiology. The role of the works of U. Harvey, R. Descartes. Formation and development of physiology in the 19th century (K. Bernard, E. Dubois-Raymon, U. Cannon, K. Ludwig, C. Sherrington).

Contribution of the works of I.M. Sechenov, I.P. Pavlov, M.E. Vvedenskiy, O.O. Ukhtomskiy, L.A. Orbeli, P.K. Anokhin, and P.G. Kostyuk to the development of world physiology.

Ukrainian Physiological School - V. Ya. Danylevskiy, V. Yu. Chagovets, D. S. Vorontsov, P. M. Serkov, P. G. Kostyuk, V. I. Skok, M. F. Shuba, G. V. Folbort, V.V. Frolkis, P.G. Rich man

Content module 2. Physiology of excitatory structures

Tasks:

- *Explain the mechanisms of the development of resting potential and action potential in nerve and muscle fibers and interpret their parameters*
- *Explain the mechanisms of electric current action on excitable structures and interpret the influence of electric impulses with different parameters on the membrane potentials of nerve and muscle fibers*
- *Draw conclusions about the excitability of nerve and muscle fibers based on the value of the depolarization threshold, membrane noise, and the summation of inhibitory and excitatory processes*
- *Explain the mechanisms and regularities of nerve impulse conduction by nerve fibers, interpret the causes of conduction disturbances*
- *Explain the mechanisms of chemical transmission of excitation through the neuromuscular synapse.*
- *Interpret the mechanisms of blockade of neuromuscular excitation*
- *Explain the mechanisms of coupling of excitation and contraction in striated muscle fibers, contraction and relaxation*
- *Interpret the dependence of the nature of muscle contraction on the strength and frequency of stimulation*
- *Interpret the role of factors on which the force of muscle contraction depends*
- *Interpret the electromyogram .*

Topic 3. Membrane potentials. Resting potential and action potential

Excitability as the basis of tissue response to irritation. Structure and functions of cell membranes. Transport of ions through membranes. Membrane ion channels, their types, functions. Membrane ion pumps, their functions. Ion gradients of the cell - ion asymmetry. Membrane receptors, their functions.

Resting membrane potential (RP), origin mechanisms, recording methods, PS parameters. Physiological role of PS.

Action potential (AP), mechanisms of origin, methods of registration, phases of AP, parameters of AP. Physiological role of PD.

Changes in cell excitability during PD development. Periods of absolute and relative refractoriness, mechanisms of their origin, physiological significance.

Changes in the membrane potential under the action of an electric current as a stimulus. Local response. Level of critical depolarization. Depolarization threshold as a measure of excitability.

Effect of current on excitable tissues, its use in clinical practice.

Topic 4. Conduction of excitation by nerve fibers and through the neuromuscular synapse.

Physiological properties of nerve fibers. Mechanisms of nerve impulse conduction by myelinated and unmyelinated nerve fibers. Patterns of excitation. The speed of excitation, the factors on which it depends. Characteristics of nerve fibers of type A, B, C.

Neuromuscular synapse, its structure, functions. Mechanisms of chemical transmission of excitation through the neuromuscular synapse. End plate potential (PKP). Physiological mechanisms of blockade of neuromuscular transmission.

Topic 5. Properties and mechanisms of contraction and relaxation of skeletal muscles.

Functions and properties of skeletal muscles. Types of muscle fibers. Types of muscle contraction depending on the frequency of irritation: single, tetanic. Types of muscle contraction depending on the change in their length and tension: isometric, isotonic. The relationship between the length of the muscle fiber and its tension. The relationship between the speed of muscle contraction and their load. Properties of body muscles. Motor units. Neurography, EEG, Evoked potentials, Electromyography. Muscle strength and work. Dynamometry. Energetics of muscle contraction.

Practical skills in the physiology of excitatory structures.

Calculate and estimate the value of the resting membrane potential, the amplitude of PD of nerve and muscle fibers, determine and calculate the depolarization limit, the speed of conduction of excitation along these structures. Calculate and graphically depict the types of muscle contraction depending on the frequency of their irritation, explain the mechanisms of muscle contraction and relaxation, neuromuscular transmission of excitation and the influence of various factors on these processes.

Content module 3. Nervous regulation of body functions

Tasks:

- *Explain the mechanisms of information transmission in the synapses of the central nervous system, the role of neurotransmitters, neuromodulators*
- *Explain the mechanisms of development of excitation and inhibition, their summation and the role of these processes in the integrative function of the central nervous system*
- *Describe the mechanisms of reflex regulation of functions and the role of the links of the reflex arc as components of the circuit of biological regulation in ensuring the adaptive response of the organism*

- Describe the contours of biological regulation of functions; explain the role of feedback in the ensured interaction of the organism with the environment
- To analyze the principles of coordination of reflexes with the participation of the relevant neural circuits in ensuring the adaptive response of the body.
- Analyze the role of different levels of the central nervous system in ensuring the body's adaptive response.

Topic 6. Biological regulation, contours of biological regulation. The reflex principle of the central nervous system (CNS).

Biological regulation, its types, circuits of biological regulation, regulated parameters, the role of feedback in the circuit of biological regulation.

Nervous regulation of functions. Neuron as a structural and functional unit of the central nervous system. Types of neurons, their functions. Neural circuits.

Reflex, reflex arc, functions of its links, mechanisms of coding and transmission of information by links of the reflex arc. The role of receptors. Nerve centers and their physiological properties. Principles of coordination of reflexes. Types of reflexes, their physiological significance.

Topic 7. Synapses of the central nervous system. Excitation and inhibition processes in the central nervous system

CNS synapses, their structure, information transmission mechanisms. Neurotransmitters (acetylcholine, norepinephrine, dopamine, glycine, GABA, glutamate, serotonin, nitric oxide, others) and neuromodulators (neuropeptides, neurosteroids, others).

Excitation and inhibition processes in the central nervous system.

Excitatory synapses, their neurotransmitters, cytoceptors, development of the excitatory postsynaptic potential (PSP), its parameters, physiological role.

Inhibitory synapses, their neurotransmitters. Postsynaptic inhibition, development of the inhibitory postsynaptic potential (IPP). Presynaptic inhibition, mechanisms of development.

Summation processes in central synapses: spatial summation, temporal summation. Summation of excitation and inhibition by CNS neurons. Lateral braking. Disinhibition.

Levels of the central nervous system, their interaction in ensuring the adaptive reactions of the body

Content module 4 . Physiology of sensory systems.

Tasks:

- *Analyze the state of the functions of the sensory system, its structural elements and auxiliary structures based on criteria differentiated for each sensory system*
- *Interpret the functions of the sense organs*
- *To analyze the age-related features of the formation and functions of sensory systems*
- *Explain the physiological basis of research methods for each of the sensory systems.*

Topic 8. General characteristics of sense organs. Somatosensory system. Physiological basis of pain.

The concept of analyzers. The importance of sensory systems in learning about the world.

Structural and functional organization of the sensory system. Receptors: classification, properties, mechanisms of excitation, functional lability. Regulation of receptor function. Concept of receptive field and reflexogenic zones. Methods of studying the excitability of receptors.

Conductive department of the sensory system. Conductive ways. Participation of the structures of the spinal cord, brain stem, and thalamus in the conduction and processing of afferent excitations. Hair follicle as a collector of afferent pathways. Functional characteristics of specific (relay, associative) and nonspecific nuclei of the thalamus.

Cortical department of the sensory system. Localization of afferent functions in the cortex. Processes of higher cortical analysis and synthesis of afferents excitement Interaction of sensory systems. Coding of information and its processing in various departments of the sensory system. Physiological basis of methods of research of sensory systems. Age-related changes in sensory systems.

Structural and functional organization of the somato-sensory system (skin and proprioceptive sensitivities). Physiological basis of pain. Nociception, physiological characteristics and classification of nociceptors (Ch. Sherrington). Nociceptive or pain system, its structural and functional organization, leading pathways and levels of information processing. Physiological meaning of pain. Antinociceptive or analgesic system, its structural and functional organization, opiate and non-opiate mechanisms, physiological role. Physiological basis of analgesia.

Topic 9. Visual sensory system.

Structural and functional organization of the visual sensory system, main and auxiliary structures. Receptor apparatus: rods and cones. Photochemical processes in receptors (rods and cones) under the action of light, the receptor potential. Sight. Refraction and accommodation. Conductive and cortical departments of the visual sensory system. Analysis of information at different levels. Formation of a visual image. Modern ideas about color perception. The

main forms of color perception disorders. Basic visual functions and physiological basis of their research methods.

Topic 10. Auditory sensory system. Vestibular sensory system.

Concept of hair cutting

Structural and functional organization of the auditory sensory system, main and auxiliary structures. Sound-conducting, perceiving and analyzing structures. Conductive and cortical departments of the auditory sensory system. Central mechanisms of sound information analysis. Theory of sound perception. Binaural hearing.

Concept of hair cutting. Peripheral sensors, integrative function, projections of the labyrinth, representations in the cortex Receptor, conduction and cortical departments, central analysis of information at different levels. Cartesian coordinate system of the brain. Perception, orientation and interaction with space.

Magnetic sensitivity

Topic 11. Taste sensory system. Olfactory sensory system

Structural and functional organization of the taste sensory system. Receptor, conductor and cortical departments, central analysis of information at different levels. The physiological role of the taste sensory system.

Structural and functional organization of the olfactory sensory system. Receptor, conductor and cortical departments, central analysis of information at different levels. Classification of smells, theories of their perception.

Content module 5. The role of the central nervous system in the regulation of motor functions

Tasks:

- To draw conclusions about the state of the motor functions of the body - posture, locomotion, motor reflexes, which take place in the experiment after a transverse section at different levels of the central nervous system and when motor structures are damaged
- To draw conclusions about the state of the motor systems of the body, which unite the structures of different levels of the central nervous system, and about their organization

- To analyze regulated parameters during the implementation of **motor** reflexes and the mechanisms of activation of receptors as **tracking** devices
- To draw conclusions about the state of motor reflexes that close at different levels of the central nervous system, to describe the structure of their reflex arcs
- To draw conclusions about the state of the conduction paths of the central nervous system, to evaluate their role in providing sensory and motor functions
- To analyze the mechanisms of the influence of the structures of the forebrain and brainstem on the activity of the motor systems of the spinal cord
- To analyze the age-related features of the regulation of motor functions
- Explain the role of the cerebral cortex and the limbic system in shaping the systemic activity of the body
- Explain the physiological basis of electroencephalography.

Topic 12 . The role of the spinal cord in the regulation of motor functions

Analysis of sensory information by the spinal cord. Motor systems of the spinal cord, their organization and coordination mechanisms (convergence, divergence, types of motoneuron inhibition - reverse, reciprocal). Physiological characteristics of proprioceptors. Muscle spindles or stretch receptors, their structure and functions. Stretch reflexes (myotatic), their reflex arcs, functions of the gamma system. Activation of alpha and gamma motoneurons by supraspinal motor centers. The role of stretch reflexes in the regulation of muscle tone (tonic myotatic reflexes) and muscle length (phasic myotatic reflexes). The clinical significance of the study of myotatic reflexes. Golgi tendon receptors, their functions, reflexes from tendon receptors, their reflex arcs, physiological significance. Flexion and extensor skin-muscle reflexes. Functional capabilities of the isolated spinal cord. Transverse section of the spinal cord and spinal shock.

Conductive function of the spinal cord, its role in the regulation of motor functions.

Topic 13 . The role of the brain stem in the regulation of motor functions . The role of the forebrain and cerebellum in the regulation of motor functions

• ***The role of the hindbrain in the regulation of motor functions***

Descending motor pathways, their role in regulating the activity of alpha and gamma motoneurons. The role of the hindbrain in secured antigravity

postures (parietal nuclei and reticular formation), mechanisms of decerebrate rigidity. Tonic labyrinthine reflexes. Hair follicle receptors of the sac and uterus, their role in the regulation of tone and posture. Tonic neck reflexes.

- ***The role of the midbrain in the regulation of motor functions***

Motor reflexes of the middle brain: static and stato-kinetic. Righting reflexes (labyrinthine, cervical). Head rotations and receptors of the semicircular canals, their physiological role in maintaining the equilibrium posture during movement with acceleration. Vestibular mechanisms of eyeball stabilization. The role of the midbrain in the regulation of stereotyped involuntary movements. Nystagmus and saccades. Approximate reflexes.

- ***The role of the reticular formation in the regulation of motor functions***

Descending and ascending influences of the reticular formation of the brain stem.

- ***The role of the thalamus and hypothalamus in the regulation of motor functions***

Functional characteristics of the nuclei of the thalamus (specific: switching, associative, motor, nonspecific) and hypothalamus (lateral nuclei, Trout's field) in the regulation of motor functions.

- ***The role of the basal nuclei in the regulation of motor functions***

Functional organization and connections of basal nuclei (caudate nucleus, shell and globus pallidum). The role of the basal nuclei in the regulation of muscle tone and complex motor acts, in the organization and implementation of motor programs. Their interaction with the subthalamic nucleus and the substantia nigra; other structures. Neurotransmitters in the system of basal nuclei, their physiological role. Cycles of the shell and caudate body. Clinical manifestations in damaged basal nuclei, their physiological mechanisms.

- ***The role of motor areas of the cortex in the regulation of motor functions***

The primary motor zone of the cortex (field 4), its functional organization and role in the regulation of motor functions. Premotor and supplementary motor areas of the cortex, their organization and role in the regulation of motor functions. Afferent connections of the motor cortex. Descending pathways: cortico-nuclear, cortico-spinal – lateral, ventral, their role in regulating the functions of the muscles of the axial skeleton, proximal and distal parts of the limbs.

Human locomotion, their regulation. Movement programming. Functional structure of voluntary movements. Age-related changes in motor functions.

- ***The role of the cerebellum in the regulation of motor functions***

Functional-structural organization of the cerebellum, its afferent and efferent connections, their physiological role. Functional organization of the cerebellar cortex. Interaction between the cerebellar cortex, cerebellar and

Extravascular fluids of the body, their role in ensuring the vital activity of body cells.

Practical skills in the physiology of the blood system

Assess the state of the blood system, its functions and regulation mechanisms based on the analysis of laboratory blood test indicators.

Evaluate the results of the hematocrit index. Determine the amount of hemoglobin, color indicator, blood groups of the AB0 system and draw conclusions.

Content module 12. Blood circulation system

Tasks:

- *Interpret the concept of the circulatory system, the mechanisms of minute blood volume regulation as an integral indicator of blood circulation based on the analysis of homeostasis parameters according to the level of metabolism*
- *Interpret the physiological properties of the heart that ensure its pumping function (automaticity, excitability, conduction, contractility), based on the analysis of the electrocardiogram (ECG), IOC and their regulation mechanisms*
- *Interpret the function of the heart as a pump on the basis of the duration of the cardiac cycle, the structure of its phases and periods, the amount of IOC, blood pressure in the chambers of the heart and in the aorta and pulmonary artery, heart tones*
- *Analyze the regulated parameters of the heart as a pump and draw conclusions about the mechanisms of its regulation*
- *Analyze the main parameters of blood circulation and draw conclusions about the state of blood vessels (compression, resistance, exchange, capacity chambers) and the mechanisms of regulation of the tone of arterial and venous vessels*
- *Analyze the condition of the vessels of the microcirculatory bed and draw conclusions about the physiological mechanisms of fluid exchange at the level of blood and lymphatic capillaries, the exchange of other substances*
- *Analyze the regulated parameters of blood circulation and draw conclusions about the mechanisms of regulation of systemic blood circulation*
- *To analyze the state of blood circulation and the mechanisms of its regulation in a person during functional tests (when changing the position of the body, physically stressed)*
- *Explain the features of regional blood circulation (coronary, cerebral, pulmonary, abdominal) and draw conclusions about the state of blood vessels in these regions and their regulation*

- *Analyze age-related changes in blood circulation parameters and draw conclusions about the physiological properties of the heart as a pump, the functions of blood vessels and the mechanisms of blood circulation regulation*
- *To explain the physiological basis of the methods of research of the circulatory system: determination of IOC, arterial and venous pressure, pulse, ECG recording, phonocardiography (FCG), echocardiography, sphygmography (SFG).*

Topic 6. General characteristics of the circulatory system.

Physiological properties of heart muscle

General characteristics of the circulatory system, its role in the body.

Structure of the heart, its functions. Heart muscle, its structure, functions.

Physiological properties of the myocardium and their features . Automatism of the heart . Action potential of atypical cardiomyocytes of the pacemaker of the heart - sinoatrial node. Leading system, its functional features, speed of conduction of excitation by heart structures. Action potential of typical cardiomyocytes. Periods of refractoriness. Mechanisms of contraction and relaxation of cardiomyocytes.

Topic 7. Physiological foundations of electrocardiography

Dynamics of excitation in the heart. Physiological basis of electrocardiography. Normal ECG.

Topic 8. Pumping function of the heart, its role in hemodynamics, physiological bases of research methods

Cardiac cycle, its phase structure. Blood pressure in the cavities of the heart and operation of the valve apparatus during cardiac activity. Systolic and minute volumes of blood, cardiac index. The work of the heart. Physiological bases of research methods: electrocardiography, phonocardiography, echocardiography, others.

Topic 9. Regulation of heart activity

Regulation of cardiac activity: myogenic, nervous, humoral. Dependence of heart contraction force on cardiomyocyte length (Frank-Starling heart law), heart contraction frequency (Bowditch ladder) and blood ejection resistance (Anrep phenomenon). Mechanisms of influence of parasympathetic and sympathetic nerves on the physiological properties of heart muscle. Mechanisms of influence of the ionic composition of blood plasma on heart activity. Mechanisms of influence of hormones on heart activity: catecholamines, thyroxine and triiodothyronine, glucagon, others.

Topic 10. Systemic blood circulation, laws of hemodynamics, role of blood vessels in blood circulation.

Systemic circulation. Basic laws of hemodynamics. Mechanism of formation of vascular tone. Total peripheral vascular resistance. Factors that ensure the movement of blood through vessels of high and low pressure. Linear and volume velocity of blood movement in different sections of the vascular bed.

Time of complete blood circulation. Blood pressure: arterial (systolic, diastolic, pulse, average), capillary, venous. Factors determining blood pressure. Physiological basis of blood pressure measurement in experiment and clinical practice. Arterial pulse, its main parameters. Sphygmogram, its assessment.

Functional classification of blood vessels. Physiological characteristics of compression, resistance (resistive) vessels.

Microcirculation. Morpho-functional characteristics of microcirculatory vessels. Movement of blood in capillaries, its features. Blood pressure in capillaries. Mechanisms of fluid and other substance exchange between blood and tissues

Physiological characteristics of capacity vessels. Peculiarities of venous blood movement. Venous pulse. Return of blood to the heart. Blood depot, its relevance.

Topic 11. Blood circulation regulation

• Regulation of vascular tone

Features of the structure and functions of vascular smooth muscles. Vascular tone and its regulation, nervous and humoral mechanisms. Peculiarities of mechanisms of microcirculatory vessel regulation. Regulation of local blood flow. The role of substances secreted by the endothelium in the regulation of vascular tone.

• Regulation of systemic blood circulation

Regulation of blood pressure and its stage.

Cardiovascular center, its structure, afferent and efferent connections. The concept of a single hemodynamic center. The main reflexogenic zones, baroreceptors and chemoreceptors of the carotid sinus and aortic arch, their role. Reflexes from the receptors of the atria and large veins. Pressor and depressor reflexes.

Interrelated mechanisms of nervous and humoral regulation of heart activity, vascular tone, and circulating blood volume during various adaptive reactions. Physiological prerequisites for blood pressure disorders. Nervous and humoral mechanisms of blood pressure regulation.

Regulation of blood circulation when changing body position. Regulation of blood circulation during physical work.

Age-related features of blood circulation and its regulation.

Topic 12. Regional blood circulation and its regulation. Dynamics of lymphatic circulation

Physiological features of regional blood circulation: pulmonary, coronary, cerebral, abdominal.

Blood circulation of the fetus. Changes in blood circulation after birth.

Lymph, its composition, quantity, functions. Mechanisms of formation and movement of lymph through lymphatic vessels.

Practical skills in the physiology of the circulatory system

Draw diagrams of PD graphs of the pacemaker of the sinoatrial node (SA), typical cardiomyocytes of the ventricles of the heart and explain the mechanisms of their development.

Analyze and interpret normal ECG, FKG, SFG, blood pressure value, cardiac cycle structure.

Draw diagrams of regulation contours systemic blood circulation in various physiological states of the body.

Interpret the role of features of regional blood circulation and its regulation (pulmonary, coronary, cerebral, abdominal) to ensure an adaptive response.

Content module 13. Respiratory system

Tasks:

- *Interpret the concept of the respiratory system and the mechanisms of regulation of gas homeostasis parameters based on the analysis of physiological criteria of the functions of the executive structures of the system that ensure breathing processes*
- *Draw conclusions about the state of each of the stages of the breathing process based on the analysis of parameters characterizing external breathing, diffusion of gases through the respiratory membrane, transportation of gases by blood, diffusion of gases between blood and tissues in accordance with the level of metabolism*
- *Draw conclusions about the state of regulation of breathing processes based on the analysis of external breathing parameters during standard physical exertion and breath-hold tests*
- *To analyze regulated parameters characterizing the state of gas exchange, and to draw conclusions about the mechanisms of regulation of the breathing process in humans under different conditions.*
- *Draw conclusions about the resistance of the airways and the regulation of their lumen based on the analysis of the results of pneumotachometry (pneumotachography)*
- *Explain the age-related features of the breathing process and their regulation*
- *Explain the physiological basis of spirometry, spirometry, pneumotachometry, determination of gas exchange parameters .*

Topic 13. General characteristics of the respiratory system. External breathing

Structure and functions of the respiratory system. Importance for breathing body. The main stages of the breathing process. External breathing. Respiratory cycle. Physiological characteristics of respiratory tracts, their functions. Meaning of ciliated epithelium. Biomechanics of inhalation and exhalation. Pressure in the pleural cavity, its changes in breathing. Elastic properties of lungs and chest walls. Surface tension of alveoli, its mechanisms. Surfactants, their meaning. Static and dynamic indicators of external breathing.

Topic 14. Gas exchange in the lungs. Transport of gases by blood

Composition of inhaled, exhaled, alveolar air. The relative constancy of the alveolar air composition. The tension of gases dissolved in the blood. Partial pressure of gases (P_{CO_2} , P_{O_2}) in alveolar air. Mechanisms of gas exchange between inhaled air and alveolar gas mixture, between alveoli and blood in pulmonary capillaries. A property of the lung membrane. Diffusion capacity of the lungs. Relationship between pulmonary circulation and lung ventilation. Anatomical and physiological "dead space".

Hemoglobin. Myoglobin. Oxyhemoglobin dissociation curve, factors affecting the formation and dissociation of oxyhemoglobin. Oxygen and carbon dioxide content in arterial and venous blood. Blood oxygen capacity. Formation and dissociation of bicarbonates and carbohemoglobin. The value of carbonic anhydrase. Gas exchange between blood and tissues. Oxygen and carbon dioxide tension in tissue fluid and cells.

Topic 15. Regulation of breathing

Structures of the central nervous system that provide respiratory periodicity. Structures of the hindbrain: the dorsal respiratory group of neurons, its role in the generation of the basic breathing rhythm and the regulation of inhalation; ventral respiratory group of neurons, its role.

The role of the pneumotaxic center in the inhibition of inhalation, regulation of the volume and frequency of breathing. The apnea center, its role.

Influence of gas composition and pH of arterial blood on frequency and depth of breathing. Central and peripheral chemoreceptors, their importance in ensuring gas homeostasis. Changes in lung ventilation with hypercapnia, hypoxia.

Lung stretch receptors, their importance in breathing regulation. Hering-Breuer reflex. The role of other receptors in breathing regulation: irritant, J -receptors, proprioceptors.

Protective respiratory reflexes. Regulation of airway resistance. Voluntary regulation of breathing. Breathing during physical work, with increased and decreased barometric pressure. Regulation of the first breath of a newborn child.

Age-related features of breathing.

Practical skills in the physiology of the respiratory system

Assess the state of each of the breathing stages and regulation mechanisms based on the analysis of the parameters characterizing the functions of the breathing stages.

Evaluate indicators of spirometry, spirometry, pneumotachometry.

Content module 14. Energy exchange

Tasks:

- *To draw conclusions about the intensity of metabolism based on the analysis of energy costs characterizing the main metabolism*
- *Draw conclusions about the predominant oxidation of proteins, fats, carbohydrates in the metabolic process based on the analysis of the respiratory coefficient*
- *To draw conclusions about the mechanisms of regulation of the intensity of metabolism based on the analysis of the value of the basic metabolism of a person*
- *To draw conclusions about the daily energy expenditure of people of various professions and the correspondence to the energy expenditure of their food rations, the need for proteins, fats, carbohydrates*
- *Analyze age-related changes in the body's energy expenditure and their regulation*
- *Explain the physiological basis of direct and indirect calorimetry methods.*

Topic 16. Energy exchange and methods of its research

General concepts about metabolism in the body. The exchange of substances between the body and the external environment as the basic conditions of life and preservation of homeostasis. Plastic and energetic role of food substances. Balance of input and output of substances.

Energy exchange. The body as an open thermodynamic system. Energy balance of the body. Physical calorimetry. Caloric value of various food substances (physical and physiological). Direct and indirect calorimetry (study of energy expenditure using complete and incomplete gas analysis). Caloric value of one liter of oxygen. Respiratory rate. The main exchange, value, conditions of its study. Specific dynamic action of food substances. Labor exchange. Energy expenditure of the body during various types of work. Age characteristics.

Physiological norms of nutrition. The need for proteins, fats, carbohydrates depending on age, type of work and body condition (pregnancy, lactation period, etc.).

Content module 15. Thermoregulation

Tasks:

- *Analyze the temperature of the core of the body of homoothermic organisms and draw conclusions about the mechanisms of regulation of the balance between heat generation and heat release*
- *To analyze the state of thermoregulation in a person under various conditions (depending on the physiological state of the body and the temperature and humidity of the environment) based on the temperature of the core of the body and the processes of heat generation and heat transfer*
- *To draw conclusions about the state of thermoregulation in a person during its hardening*
- *To analyze the age-related features of human thermoregulation and its regulation*
- *Explain the physiological basis of thermoregulation research methods: thermometry, thermography, sweating, infrared radiation*

Topic 17. Body temperature and regulation of its stability

Stability of the temperature of the internal environment as a necessary condition for the normal state of metabolic processes. Poikilothermia, homoiothermia. Human body temperature, its daily fluctuations. The temperature of different areas of the skin and internal organs of a person. Physical and chemical thermoregulation. Exchange substances as a source of heat generation. The role of individual organs in heat production. Heat transfer. Methods of heat transfer from the body surface (radiation, conduction, convection, evaporation). Physiological mechanisms of heat transfer (blood movement in skin vessels, sweating, etc.).

Thermoregulation center. Peripheral and central thermoreceptors. Nervous and humoral mechanisms of thermoregulation. Regulation of body temperature during changes in the temperature of the external environment. Physiological bases of hardening. Age and sex characteristics of thermoregulation.

Content module 16. Digestive system

Tasks:

- *Interpret the concepts of the digestive system and the mechanisms of regulation of its physiological functions (secretory, motor, absorption).*

- *Draw conclusions about the role of the taste sensory system in determining the suitability of food for consumption and regulation of the motor and secretory functions of the digestive system*
- *Assess the state of the digestive system based on the analysis of the parameters of the hydrolysis of food substances, the speed of their movement in the alimentary canal, homeostasis parameters that reflect absorption processes*
- *Draw conclusions about the state of digestion processes in each of the departments of the alimentary canal based on the analysis of the state of the secretory, motor, and absorption functions and their regulation*
- *Analyze the regulated parameters of homeostasis and draw conclusions about the state of processes of absorption of substances in the alimentary canal and mechanisms of regulation*
- *To analyze the age-related features of the functions of the digestive system and their regulation*
- *To explain the physiological basis of modern methods of studying the secretory, motor, and absorptive functions of the digestive system*
- *To explain the mechanisms of formation of hunger and satiety motivations based on the analysis of homeostatic indicators of nutrients in the blood and the state of the digestive tract.*

Topic 18. General characteristics and functions of the digestive system. Digestion in the oral cavity. The role of taste and smell sensory systems

Structure and functions of the digestive system. Alimentary canal and digestive glands. The main functions of the digestive system: secretion, motility, absorption.

Digestion: its types (cavity, membrane, intracellular), main stages. Features of secretory cells, mechanisms of secretion, the role of calcium ions and cellular mediators in the secretory process. Basic principles and mechanisms of digestion regulation. Gastrointestinal hormones. Main secretion phases digestive glands Periodic activity of digestive organs.

Motility of the alimentary canal. Features of the structure and functions of the smooth muscles of the alimentary canal.

Physiological basis of the methods of researching the functions of the alimentary canal.

Digestion in the oral cavity.

The role of the taste sensory system. Receptor, conductor and cortical departments. Types of taste sensations, significance for digestion. Interaction with the olfactory sensory system, its importance in determining the nature of food.

Mechanical and chemical processing of food. Salivation. The amount, composition and properties of saliva, its importance in digestion, mechanisms of secretion (primary, secondary saliva). Regulation of saliva secretion.

Chewing, its features depending on the type of food, regulation of chewing. Swallowing, its phases, regulation.

Topic 19. Digestion in the stomach

Secretory activity of gastric glands. Research methods. Composition and properties of gastric juice. Mechanisms of secretion of hydrochloric acid, enzymes, mucus and their regulation. Nervous and humoral regulation of gastric gland secretion, phases of secretion regulation: cephalic, gastric, intestinal. Adaptive changes in gastric secretion. Motor function of the stomach, its regulation.

Topic 20. Digestion in the duodenum. The role of pancreatic juice and bile in digestion processes. Digestion in the intestines.

External secretory activity of the pancreas. Amount, composition and properties of pancreatic juice, its role in digestion. Nervous and humoral regulation of pancreatic secretion. Phases of secretion regulation: cephalic, gastric, intestinal.

The role of the liver in digestion. Formation of bile, its composition and properties. Research methods. Hepatic and cystic bile. Participation of bile in digestion. Regulation of the formation of bile and its release in the duodenum.

Intestinal secretion, composition and properties of intestinal juice, its role in digestion. Research methods. Regulation of intestinal secretion. Cavity and membrane hydrolysis of food substances. Motor activity of the small intestine, its role in digestion. Types of motility, its regulation. The role of the metasympathetic system in the regulation of the secretory and motor functions of the intestines.

Digestion in the colon. The role of gut microflora. Colon motility, its regulation. Act of defecation.

Topic 21. Absorption processes in the gastrointestinal tract.

Absorption processes. Research methods. Absorption of substances in different departments of the alimentary canal, its mechanisms. Features of absorption of water, salts, carbohydrates, proteins, fats, vitamins, and other substances. Adjustment of suction.

Topic 22. Physiological bases of hunger and satiety.

Physiological basis of hunger and satiety. Food motivation. Concept of food center (hunger center) and satiety center. Short-term and long-term mechanisms of food intake regulation and body weight maintenance. The role of ghrelin ("hunger hormone"), other gastrointestinal hormones and adipose tissue hormones - leptins in the regulation of food intake. The contour of the regulation of maintaining the stability of the content of nutrients in the internal environment, eating behavior and stability of body weight.

Practical skills in the physiology of the digestive system

To assess the state of secretory, motor, and absorption functions in different departments of the alimentary canal.

Draw schemes of reflex arcs of autonomous reflexes and the influence of hormones that regulate the secretory, motor, and absorption functions of the digestive system, the circuit of the regulation of eating behavior.

Content module 17. Selection system

Tasks:

- *Interpret the concept of the secretion system, mechanisms of homeostasis regulation with its participation based on the analysis of homeostasis constants: volume of circulating blood, concentration of ions, osmotic pressure, acid-base state*
- *To draw conclusions about the state of the processes underlying the formation of urine in the kidneys based on the analysis of clearance (rate of filtration in the glomeruli, secretion and reabsorption of substances and water in different parts of the nephron).*

Topic 23. General characteristics of the allocation system. The role of kidneys in excretion processes, mechanisms of urine formation

The allocation system, its structure, functions. Excretory organs (kidneys, skin, lungs, alimentary canal), their participation in maintaining body homeostasis. Kidneys as the main organs of the excretory system. Nephron as a structural and functional unit of the kidney. Blood circulation in the kidney, its features. The main processes of urine formation: filtration, reabsorption, secretion. Filtering mechanisms, composition of primary urine. Filter speed adjustment. Reabsorption in tubules, its mechanisms. Reversible - countercurrent - multiple system, its role. Secretory processes in proximal and distal tubules and collecting tubules. Final urine, its composition, quantity. The clearance coefficient and determination of the rate of filtration, reabsorption, secretion, the amount of renal plasma circulation and blood circulation.

Topic 24. The role of kidneys in maintaining homeostasis

Regulation of urination. Involvement of kidneys in maintaining nitrogen balance, parameters of homeostasis. Regulation of constancy of internal osmotic pressure, role of vasopressin. Mechanisms of thirst.

Regulation of stability of the concentration of sodium, potassium ions, volumes of water and circulating blood in the body with the participation of the kidneys: the role of the renin-angiotensin-aldosterone system, atrial natriuretic hormone.

Regulation of the constancy of the concentration of calcium and phosphate ions with the involvement of the kidneys.

The role of the kidneys in the regulation of the acid-base state of the internal environment.

Urination and its regulation.

Physiological basis of methods of research of kidney function.

Age-related changes in urine formation and urination.

3. STRUCTURE OF THE EDUCATIONAL DISCIPLINE

Topic	Lectures	Practical training	S.S.
MODULE 1 "General physiology and higher integrative functions"			
<i>Content module 1. Introduction to physiology</i>			
1. The subject and tasks of physiology. Methods of physiological research	1	3	2
2. The main stages of the development of physiology. The history of the development of physiology in the 19th century. The contribution of the works of I.M. Sechenov, I.P. Pavlov, P.K. Anokhin, and P.G. Kostyuk to the development of world physiology. Ukrainian Physiological School	-	-	2
<i>Content module 2. Physiology of excitatory structures</i>			
3. Membrane potentials. Resting potential and action potential	1	3	2
4. Conduction of excitation by nerve fibers and through the neuromuscular synapse	-	3	2
5. Properties of skeletal muscles and mechanisms of their contraction.	-	3	2
<i>Content module 3. Nervous regulation of body functions</i>			
6. Contours of biological regulation of functions. The reflex principle of the central nervous system	1	3	2
7. CNS synapses. Excitation and inhibition in the central nervous system	1	3	2
<i>Content module 4. Physiology of sensory systems</i>			
8. General characteristics of sense organs. Somatosensory system. Physiological basis of pain.	1	3	2
9. Visual sensory system	-	3	2
10. Auditory sensory system. Vestibular sensory system. Prionok	1	3	3
11. Taste sensory system. Olfactory sensory system	-	-	2
<i>Content module 5. The role of the central nervous system in the regulation of motor functions</i>			
12. The role of the spinal cord in the regulation of motor functions	-	3	2
13. The role of the brain stem in the regulation of motor functions. The role of the forebrain and cerebellum in the regulation of motor functions of the body.	2	3	2
<i>Content module 6. The role of the autonomic nervous system in the regulation of visceral functions</i>			
14. Structural and functional organization of the autonomic nervous system, its role in the regulation of visceral functions	2	3	2

Content module 7. Humoral regulation and the role of endocrine glands in the regulation of visceral functions			
15. Humoral regulation, its factors, mechanisms of hormone action on target cells, regulation of hormone secretion	2	3	2
16. The role of hormones in the regulation of processes of mental, physical and sexual development	-	3	2
17. The role of hormones in the regulation of homeostasis and adaptation of the body to the action of stress factors	-	3	2
Content module 8. Physiological bases of behavior. Physiology of emotions.			
18. Physiological bases of behavior. Innate reflexes and instincts. Processes and mechanisms of formation and inhibition of conditioned reflexes.	2	3	3
19. Physiology of emotions, their types. Theories of emotions and mechanisms of their development. Types of GNI. Emotional tension and its manifestation	-	3	3
Content module 9. Cognitive functions.			
20. Cognitive indicators: language skills, praxis, gnosis, memory, attention, intelligence, learning. Physiology of sleep.	2	3	3
Content module 10. Physiological foundations of work and sports.			
21. Muscular and mental performance, their indicators and periods. Theories of fatigue development. Relationship between physical and mental work. Training.	2	3	3
Final modular control	-	3	8
TOTAL HOURS – 135	20	60	55

MODULE 2 " Physiology of visceral systems"

Content module 11. Blood system

1. General characteristics of the blood system. Functions of blood, physical and chemical properties of blood	2	3	2
2. Physiology of erythrocytes	-	3	3
3. Blood groups	-	3	3
4. Protective functions of blood. Physiology of leukocytes	2	3	3
5. Types and mechanisms of hemostasis. Physiology of platelets	-	3	3

Content module 12. Blood circulation system

6. General characteristics of the circulatory system. Physiological properties of heart muscle	2	3	2
7. Dynamics of heart excitation. Physiological basis of electrocardiography	-	3	2
8. Pumping function of the heart, its role in hemodynamics, physiological basis of research methods	1	3	2
9. Regulation of heart activity	1	3	2

10. Systemic blood circulation. Laws of hemodynamics, the role of blood vessels in blood circulation	2	3	2
11. Regulation of blood circulation	2	3	2
12. Peculiarities of regional blood circulation and its regulation. Dynamics of lymphatic circulation.	-	-	2
Content module 13. Respiratory system			
13. General characteristics of the respiratory system. External breathing	1	3	2
14. Gas exchange in the lungs. Transport of gases by 'blood	1	3	2
15. Regulation of breathing	2	3	2
Content modules: 14. Energy exchange. 15. Thermoregulation			
16. Energy exchange and methods of its research	-	3	3
17. Body temperature and regulation of its stability	-	3	3
Content module 16. Digestive system			
18. General characteristics and functions of the digestive system. Digestion in the oral cavity. The role of taste and smell sensory systems	2	3	2
19. Digestion in the stomach	1	3	2
20. Digestion in the duodenum. The role of pancreatic juice and bile in digestion processes. Digestion in the intestines.	1	3	2
21. Absorption processes in the gastrointestinal tract.	1	3	1
22. Physiological foundations of hunger and satiety.	1	-	
Content module 17. Selection system			
23. Allocation system. The role of kidneys in excretion processes, mechanisms of urine formation	2	3	2
24. The role of kidneys in maintaining homeostasis	2	3	2
25. Develop a circuit diagram of biological regulation of homeostasis parameters with the participation of kidneys - individual independent work of students *	-	-	3*
Final modular control		4	8
TOTAL HOURS - 165	30	70	65
TOTAL PER COURSE - 300	50	130	120

4. THEMATIC PLAN OF LECTURES

3rd semester

No.	TOPIC	Hours
1	Introduction to the course of physiology. Irritable tissues. Biopotentials.	2
2	Contours of biological regulation of functions. The reflex principle of the central nervous system	2
3	Excitation and inhibition in the central nervous system. Principles of coordination of reflex activity. CNS synapses.	2
4	Analyzers. Somatosensory system. Physiological basis of pain.	2
5	Brain stem. The role of the forebrain and cerebellum in the regulation of motor functions, systemic activity of the body.	2
6	The role of the autonomic nervous system in the regulation of visceral functions.	2
7	humoral regulation, its factors, mechanisms of hormone action on target cells, regulation of hormone secretion	2
8	Physiological bases of behavior. Processes and mechanisms of formation and inhibition of conditioned reflexes.	2
9	The concept of GNI. Cognitive functions. Physiology of sleep.	2
10	Muscular and mental performance. The theory of fatigue development. Training.	2
	TOTAL	20

4th semester

No.	TOPIC	Hours
1.	General characteristics of the blood system. Blood as a means of transport and the internal environment of the body	2
2.	Physiology of erythrocytes. Protective functions of blood. Blood groups	2
3.	Vascular-platelet and coagulation hemostasis. The role of anticoagulants and plasmins	2
4.	Circulatory system. Physiological properties of heart muscle	2
5.	Pumping function of the heart, regulation of heart activity	2
6.	The role of blood vessels in blood circulation. Basic principles of blood circulation	2
7.	Regulation of blood flow through vessels. Regulation of systemic blood circulation	2
8.	Respiratory system. The main stages of breathing . Regulation of breathing	2
9.	Energy exchange and thermoregulation	2
10.	Digestive system. The role of taste and smell sensory systems. Digestion in the oral cavity	2
11.	Digestion in the stomach and duodenum	2
12.	Digestion and absorption in the intestines	2
13.	Physiological basis of hunger and satiety.	2
14.	Allocation system. Mechanisms of urine formation	2
15.	Regulation of formation and excretion of urine. The role of kidneys in maintaining homeostasis	2
	TOTAL	30

5. THEMATIC PLAN OF PRACTICAL LESSONS

III semester

No.	TOPIC	Hours
	MODULE 1	
1	The subject and tasks of physiology. Methods of physiological research	3
2	Registration of resting potential and action potential of nerve and muscle fibers	3
3	Study of conduction of excitation by nerve fibers and through the neuromuscular synapse. Study of the action potential of intact nerves and muscles	3
4	Study of the mechanisms of skeletal muscle contraction	3
5	Study of the reflex arc	3
6	Research processes of excitation and inhibition in the central nervous system	3
7	Research of the somato-sensory system	3
8	Research of the visual sensory system	3
9	Study of the auditory sensory system	3
10	Study of the role of the spinal cord in the regulation of motor functions of the body	3
11	Study of the role of the brain stem in the regulation of motor functions body	3
12	Study of mechanisms of nervous regulation of visceral body functions	3
13	Study of mechanisms of humoral regulation of visceral body functions	3
14	Study of the role of hormones in the regulation of physical, mental, and sexual development	3
15	Study of the role of hormones in the regulation of homeostasis and adaptation of the body to the action of stress factors	3
16	Study of formation and inhibition of conditioned reflexes	3
17	Research of cognitive functions	3
18	Study of GNI types.	3
19	Study of fatigue and recovery during muscle work and adaptation of the body to physical exertion.	3
20	Final modular control	3
	TOTAL	60

And V semester

No.	TOPIC	Hours
	MODULE 2	
1	Blood system. Research of physical and chemical properties of blood	3
2	Study of the number of erythrocytes and hemoglobin in the blood	3
3	Study of group affiliation of blood	3
4	Protective properties of blood. Research of the leukocyte formula	3
5	Blood coagulation studies	3
6	Circulatory system. Study of the physiological properties of the heart muscle	3
7	Study of the dynamics of cardiac excitation. ECG registration and analysis	3

8	Study of the pumping function of the heart	3
9	Study of heart regulation	3
10	The role of blood vessels in blood circulation. Study of human blood pressure	3
11	Study of regulation of blood circulation	3
12	Respiratory system. Study of external breathing	3
13	Study of diffusion, transport of gases by blood	3
14	Study of breathing regulation	3
15	Research of energy exchange	3
16	Study of thermoregulation	3
17	Digestive system. Study of digestion in the oral cavity. The role of taste and smell sensory systems	3
18	Study of digestion in the stomach	3
19	Study of digestion in the duodenum. Studies of digestion in the intestines	3
20	Absorption processes in the gastrointestinal tract	3
21	Study of the mechanisms of urine formation	3
22	Study of the participation of the kidneys in maintaining homeostasis	3
23.	Final modular control 2	4
	TOTAL	70

6. THEMATIC PLAN OF INDEPENDENT WORK OF STUDENTS

3rd semester

No.	MODULE 1 TOPIC	Number of hours	type of control
1	Preparation for practical classes – theoretical preparation and development of practical skills	36	Current control in practical classes
2	Independent study of topics that are not part of the classroom lesson plan:		
	The history of the development of physiology in the 19th century	2	Final modular control
	The contribution of the works of I.M. Sechenov, I.P. Pavlov, Yu.V. Chagovets, and P.G. Kostyuk to the development of world physiology. Ukrainian Physiological School	2	-“-
	Vestibular sensory system	3	-“-
	Taste and smell sensory systems	2	-“-
3.	Individual independent work:		
	Literature analysis and discussion on the topic: "Sleep, its types, mechanisms, biological role"	2	Current control
4.	Preparation for the final modular control	8	Final modular control
	TOTAL	55	

4th semester

No.	MODULE 2 TOPIC	Number of hours	Types of control
1.	Preparation for practical classes – theoretical preparation and development of practical skills	50	Current control in practical classes
2	Working on topics that are not part of the classroom lesson plan:		
	Dynamics of lymphatic circulation	2	Final modular control
	Physiology of regional blood circulation	2	“-“
3.	<i>Individual SRS: Develop a circuit diagram of homeostasis regulation with the participation of the kidneys</i>	3	Current control
3	Preparation for the final modular control	8	Final modular control
	TOTAL	65	

7. LIST OF THEORETICAL QUESTIONS TO PREPARE STUDENTS FOR THE FINAL MODULAR TEST

Module 1. General physiology and higher integrative functions

List of theoretical questions

Content module 1: Introduction to physiology

1. Physiology as a science. The concept of functions. Methods of physiological research.
2. Formation and development of physiology in the 19th century.
3. The contribution of the works of I.M. Sechenov, I.P. Pavlov, P.K. Anokhin, and P.G. Kostyuk to the development of world physiology.
4. Ukrainian Physiological School.

Content module 2: Physiology of excitatory structures

1. Resting potential, mechanisms of origin, its parameters, physiological role.
2. Action potential, mechanisms of origin, its parameters, physiological role.
3. Excitability. Critical level of depolarization, threshold of cell membrane depolarization.
4. Changes in cell excitability during the development of a single action potential.
5. The value of parameters of electrical stimuli for the occurrence of excitation.
6. Mechanisms of excitation by nerve fibers.
7. Patterns of conduction of excitation by nerve fibers.
8. Mechanisms of excitation transmission through the neuromuscular synapse.
9. Conjugation of excitation and contraction. Mechanisms of contraction and relaxation of skeletal muscles.
10. Types of muscle contractions: single and tetanic; isotonic and isometric.

Content module 3. Nervous regulation of body functions

1. Biological regulation, its types and significance for the body. Contours of biological regulation. The role of feedback in regulation.
2. The concept of a reflex. The structure of the reflex arc and the functions of its links.
3. Receptors, their classification, mechanisms of excitation.
4. Proprioceptors, their types, functions. Structure and functions of muscle spindles.
5. Mechanisms and patterns of excitation transmission in central synapses.
6. Types of central braking. Mechanisms of development of presynaptic and postsynaptic inhibition.
7. Summation of excitation and inhibition by CNS neurons.

Content module 4. Physiology of sensory systems

1. Sensory systems, their structure and functions.
2. Taste sensory system, its structure, functions, research methods.
3. Olfactory sensory system, its structure and functions.
4. Somatosensory system, its structure and functions.
5. Physiological mechanisms of pain.
6. Opiate and non-opiate antinociceptive systems of the body, their importance.
7. Physiological mechanisms of pain relief.
8. Auditory sensory system, its structure and functions.
9. Vestibular system, its functions.
10. Visual sensory system, its structure and functions.
11. Basic visual functions and methods of their research.

Content module 5: The role of the central nervous system in the regulation of motor functions

1. Motor reflexes of the spinal cord, their reflex arcs, physiological significance.
2. Conductive function of the spinal cord. Dependence of spinal reflexes on the activity of brain centers. Spinal shock.
3. Motor reflexes of the hindbrain, decerebrate rigidity.
4. Motor reflexes of the middle brain, their physiological significance.
5. Cerebellum, its functions, symptoms of damage.
6. Thalamus, its functions.
7. Limbic system, hypothalamus, their functions.
8. Basal nuclei, their functions, symptoms of damage.
9. Sensory, associative and motor zones of the cerebral cortex, their functions.
10. Interactions of different levels of the central nervous system in the regulation of motor functions. Locomotion, their regulation. Functional structure of voluntary movements. Age-related changes in motor functions.

Content module 6: The role of the autonomic nervous system in the regulation

of visceral functions

1. General plan of the structure of the autonomic nervous system. Autonomic reflexes, their reflex arcs.
2. Synapses of the autonomic nervous system, their mediators, cytoceptors and blockers of transmission of excitation in synapses.
3. Influence of the sympathetic nervous system on visceral functions.
4. Influence of the parasympathetic nervous system on visceral functions.
5. The role of the metasymphathetic system in the regulation of visceral functions.
6. The unity of the sympathetic and parasympathetic systems in the regulation of functions.

Content module 7. Humoral regulation and the role of endocrine glands in the regulation of visceral functions

1. Humoral regulation, its differences from nervous regulation. Characteristics of factors of humoral regulation.
2. Properties of hormones, their main effects. Mechanism of action of hormones on target cells.
3. Contour of humoral regulation. Regulation of hormone secretion by endocrine glands.
4. The role of the hypothalamic-pituitary system in regulating the functions of the endocrine glands.
5. The role of somatotropin, thyroxine and triiodothyronine, insulin in the regulation of linear growth of the body, processes of physical and mental development of the body.
6. The role of calcitonin, parathyroid hormone, and calcitriol in regulating the stability of the concentration of calcium ions and phosphates in the blood.
7. The role of pancreatic hormones in the regulation of body functions.
8. The role of thyroid hormones (T₃, T₄) in the regulation of body functions.
9. Physiology of the female reproductive system, its functions, the role of sex hormones.
10. Physiology of the male reproductive system, the role of sex hormones.
11. A general idea of non-specific adaptation of the body to a stressful situation. The role of hormones in non-specific adaptation.
12. The role of the sympatho-adrenal system in the regulation of non-specific adaptation of the body to a stressful situation.
13. The role of the pituitary-adrenal system in the regulation of non-specific adaptation of the body to a stressful situation. The main effects of glucocorticoids and mineralocorticoids on the body.

Content module 8. Physiological bases of behavior

1. Biological forms of behavior. Needs and motivations, their role in shaping behavior.
2. Innate forms of behavior. Instincts, their physiological role.
3. Acquired forms of behavior. Mechanisms of formation of conditioned reflexes, their differences from unconditioned ones.

4. Emotions, formation mechanisms. Biological and informational theories of emotions. Their role in shaping behavior

Content module 9. Cognitive functions

1. Functions of the new cortex of the brain and higher nervous activity of a person.

2. Functional asymmetry of the cerebral cortex, its integrative function.

3. Language, its functions, physiological foundations of formation.

4. Thinking. Development of abstract thinking in a person. The role of brain structures in the thinking process.

5. Memory: types and mechanisms of formation.

6. Types of higher human nervous activity. Temperament and character.

7. Sleep, its types, phases, electrical activity of the cortex, physiological mechanisms.

Content module 10. Physiological foundations of work and sports

1. Physiological foundations of human labor.

2. Peculiarities of physical and mental work. Optimal work modes.

3. Physiological mechanisms of fatigue. Active recreation and its mechanisms.

4. Age-related changes in human capacity for work.

5. Physiological foundations of sports. Principles of building optimal training regimens.

List of practical tasks

1. Calculate function parameters and graphically display the processes occurring in excitable structures.

2. Draw diagrams and explain the structure and mechanisms:

- contours of biological regulation, reflex arcs of motor reflexes;
- development of processes of excitation and inhibition in the central nervous system, processes of their summation and coordination of reflexes;
- reflex arcs of motor reflexes at these levels of the central nervous system and conductive pathways that ensure the interaction of different levels of the central nervous system;
- reflex arcs of autonomous reflexes that ensure the regulation of visceral functions, the action of various hormones on target cells and the regulation of their secretion, the contours of the regulation of visceral functions with the participation of hormones.

3. Assess the state of sensor systems based on the indicators of their functions.

4. Draw diagrams of the structure of specific information transmission channels in sensory systems and explain the mechanisms of formation of the corresponding sensations and images of external reality.

5. Draw diagrams explaining the formation of biological forms of behavior and interpret the mechanisms of each of its stages, the role of emotions in behavior.

6. Evaluate and interpret the results of studies characterizing the types of human GNI.

7. Assess the state of the body during physical exertion by function indicators.

Module 2. Physiology of visceral systems

List of theoretical questions

Content module 11. Blood system

1. General characteristics of the blood system. Composition and functions of blood. Concept of homeostasis.
2. Blood plasma electrolytes. Blood osmotic pressure and its regulation.
3. Blood plasma proteins, their functional significance. Erythrocyte sedimentation rate (ESR).
4. Oncotic pressure of blood plasma and its role.
5. The acid-base state of blood, the role of blood buffer systems in maintaining its stability.
6. Erythrocytes, their functions. Regulation of erythropoiesis.
7. Types of hemoglobin and its compounds, their physiological role.
8. Leukocytes, their functions. Regulation of leukopoiesis. Physiological leukocytosis.
9. Platelets, their physiological role.
10. Vascular-platelet hemostasis, its mechanisms and physiological significance.
11. Coagulation hemostasis, its mechanisms and physiological significance.
12. Coagulants, anticoagulants, fibrinolysis factors, their physiological significance.
13. Physiological characteristics of the AB0 blood system. Conditions of blood compatibility of the donor and the recipient. Samples before blood transfusion.
14. Physiological characteristics of the Rhesus blood system (CDE). The significance of Rh-affinity in blood transfusion and pregnancy.

Content module 12. Blood circulation system

1. General characteristics of the circulatory system. Factors that ensure the movement of blood through vessels, its directionality and continuity.
2. Automatism of the heart. The gradient of automatism. Stanius' experiment.
3. Action potential of atypical cardiomyocytes of the sino-atrial node, mechanisms of origin, physiological role.
4. Conductive system of the heart. Sequence and speed of conduction of excitation in the heart.
5. Action potential of typical ventricular cardiomyocytes, mechanisms of origin, physiological role. Correlation in time of PD and single contraction of the myocardium.
6. Periods of refractoriness during the development of PD of typical cardiomyocytes, their significance.
7. Coupling of excitation and contraction in the myocardium. Mechanisms of contraction and relaxation of the myocardium.

8. Vector theory of ECG formation. Electrocardiographic leads. Origin of ECG waves, segments, intervals.

9. Cardiac cycle, its phases, their physiological role.

10. The role of heart valves. Tones of the heart, mechanisms of their origin. FCG, its analysis.

11. Arterial pulse, its origin. SFG, its analysis.

12. Myogenic mechanisms of heart activity regulation.

13. The nature and mechanisms of effects of sympathetic nerves on heart activity. The role of sympathetic reflexes in the regulation of cardiac activity.

14. Nature and mechanisms of effects of parasympathetic nerves on heart activity. The role of parasympathetic reflexes in the regulation of cardiac activity.

15. Humoral regulation of heart activity. Dependence of heart activity on changes in the ionic composition of blood.

16. Features of the structure and function of various departments of blood vessels. The basic law of hemodynamics.

17. Value of blood viscosity for blood circulation.

18. Linear and volume velocity of blood movement in different sections of the vascular bed. Factors affecting their value.

19. Blood pressure and its changes in different parts of the vascular bed.

20. Blood pressure, factors determining its value. Blood pressure registration methods.

21. Blood circulation in capillaries. Mechanisms of fluid exchange between blood and tissues.

22. Blood circulation in the veins, the effect of gravity on it. Factors determining the value of venous pressure.

23. Tone of arterioles and venules, its importance. Influence of vascular-motor nerves on vascular tone.

24. Myogenic and humoral regulation of vascular tone. The role of substances secreted by the endothelium of vessels in the regulation of vascular tone.

25. Hemodynamic center. Reflex regulation of vascular tone. Pressor and depressor reflexes.

26. Reflex regulation of blood circulation when changing the position of the body in space (orthostatic test).

27. Regulation of blood circulation during muscle work.

28. Features of blood circulation in the vessels of the brain and its regulation.

29. Features of blood circulation in heart vessels and its regulation.

30. Peculiarities of pulmonary circulation and its regulation.

31. Mechanisms of lymph formation. Movement of lymph in vessels.

Content module 13. Respiratory system

1. General characteristics of the respiratory system. The main stages of breathing. Biomechanics of inhalation and exhalation.

2. Elastic traction of the lungs, negative pressure in the pleural space.

3. External breathing. Indicators of external breathing and their assessment.
4. Anatomical and physiological "dead space"; its physiological role.
5. Diffusion of gases in the lungs. Diffusion capacity of the lungs and the factors on which it depends.
6. Transport of oxygen by blood. Blood oxygen capacity.
7. Oxyhemoglobin dissociation curve, factors affecting its course.
8. Transport of carbon dioxide by blood. The role of erythrocytes in carbon dioxide transport.
9. Physiological role of respiratory tracts, regulation of their lumen.
10. Respiratory center, its structure, regulation of breathing rhythm.
11. The mechanism of the first breath of a newborn child.
12. The role of lung stretch receptors and afferent fibers of vagus nerves in the regulation of breathing.
13. The role of central and peripheral chemoreceptors in the regulation of breathing. Blood components that stimulate external respiration.
14. Regulation of external breathing during physical exertion.

Content module 14. Energy exchange and thermoregulation

1. Sources and ways of using energy in the human body.
2. Methods of determining human energy expenditure. Respiratory rate.
3. The main exchange and conditions for its definition, factors affecting its value.
4. Labor exchange, meaning of its definition.

Content module 15. Thermoregulation

1. Human body temperature, its daily fluctuations.
2. Physiological significance of homiothermy. Thermoregulation center, thermoreceptors.
3. Heat generation in the body, its regulation.
4. Heat transfer in the body, its regulation.
5. Regulation of constancy of body temperature at different ambient temperatures.
6. Physiological bases of hardening.

Content module 16. Digestive system

1. General characteristics of the digestive system. Digestion in the oral cavity. Chewing, swallowing.
2. The composition of saliva, its role in digestion.
3. Mechanisms of saliva production, primary and secondary saliva.
4. Regulation of salivation. The effect of stimulus properties on the quantity and quality of saliva.
5. Methods of studying the secretory function of the stomach in humans. Composition and properties of gastric juice. Mechanisms of hydrochloric acid secretion.
6. Complex-reflex ("cephalic") phase of gastric secretion regulation.

7. Neurohumoral ("gastric and intestinal") phase of gastric secretion regulation. Enteral stimulants and inhibitors of gastric secretion.
8. Nervous and humoral mechanisms of inhibition of gastric secretion.
9. Motor function of the stomach and its regulation. Mechanisms of the passage of gastric contents into the duodenum.
10. Research methods of pancreatic juice secretion in humans. Composition and properties of pancreatic juice.
11. Phases of regulation of the secretory function of the pancreas.
12. Methods of research of bile secretion in humans. Composition and properties of bile.
13. Regulation of formation and secretion of bile. Mechanisms of entry of bile into the duodenum.
14. Composition and properties of intestinal juice. Regulation of its secretion. Cavity and membrane etching.
15. Absorption in the alimentary canal. Mechanisms of absorption of sodium ions, water, carbohydrates, proteins, fats.
16. Motor function of intestines, types of contractions, their regulation.
17. Physiological mechanisms of hunger and satiety.

Content module 17. Selection system

1. General characteristics of the allocation system. The role of kidneys in excretion processes. Features of kidney blood supply.
2. Mechanisms of urine formation. Filtration in the glomeruli and the factors on which it depends.
3. Reabsorption and secretion in the nephron, their physiological mechanisms.
4. Reversible-countercurrent-multiple system of nephrons, its physiological mechanisms and role.
5. Regulation of sodium and water ion reabsorption in nephron tubules.
6. The role of the kidneys in ensuring isosmium. Mechanisms of thirst.
7. The role of the kidneys in ensuring isovolume.
8. The role of the kidneys in ensuring the stability of the acid-base state of the blood.
9. Urination and its regulation.

List of practical tasks

1. Determine the hemoglobin content in the blood according to the Sali method, evaluate the results.
2. Determine the group of the studied blood in the AB0 system, draw conclusions.
3. Calculate the color indicator of blood, draw conclusions.
4. Determine the hematocrit index, draw conclusions.
5. Determine the blood pressure level of the subject, draw a conclusion.
6. Determine the duration of the period of tension of the ventricles of the heart based on the analysis of the polycardiogram, draw a conclusion.

7. Determine the duration of the period of expulsion of blood from the ventricles of the heart based on the polycardiogram analysis, draw a conclusion.
8. Determine the duration of the total systole of the ventricles of the heart based on the analysis of the polycardiogram, draw a conclusion.
9. Determine the duration of the phase of isometric contraction of the ventricles of the heart based on the analysis of the polycardiogram, draw a conclusion.
10. Determine the direction and amplitude of the waves of the electrocardiogram in standard leads. Draw conclusions.
11. Determine the duration of the cardiac cycle based on ECG analysis. Conclude.
12. Calculate the duration of the PQ interval based on the ECG analysis. Conclude.
13. Calculate the duration of the Q-T interval based on the ECG analysis. Conclude.
14. Calculate the duration of the QRS complex based on the ECG analysis. Conclude.
15. Determine on the basis of the ECG analysis, which is the driver of the heart rhythm. Argue the conclusion.
16. Determine the vital capacity of the lungs by the method of spirometry. Conclude.
17. Determine your respiratory volume by spirometry. Conclude.
18. Determine the reserve volume of inspiration by the method of spirometry. Conclude.
19. Determine the reserve volume of exhalation by the method of spirometry. Conclude.
20. Calculate the respiratory volume, the vital capacity of the lungs according to the spirogram. Conclude.
21. Calculate the reserve volume of inhalation and exhalation according to the spirogram. Conclude.
22. Calculate the minute volume of breathing according to the spirogram. Conclude.
23. Calculate the maximum ventilation of the lungs according to the spirogram, draw conclusions.
24. Calculate the respiratory reserve according to the spirogram. Conclude.
25. Determine the spirogram of oxygen consumption of the subject at rest and during the first minute after physical exertion, draw conclusions.
26. Determine the spirogram of oxygen consumption of the subject at rest and within three minutes after exercise, draw conclusions.
27. Calculate the main metabolism of the subject, determining oxygen consumption according to the spirogram registered in standard conditions, draw a conclusion.
28. Perform breath-holding tests. Analyze the results.

29. How and why will salivation change after administering atropine to a person?
30. To assess the secretory function of the stomach in humans.
31. Why is a dairy diet recommended for increased acidity of gastric juice?
32. How and why will the secretion of pancreatic juice change when the acidity of gastric juice decreases?
33. How will a decrease in the content of bile acids in bile affect the digestion process? Why?
34. Offer means to increase the motor function of the intestines. Give their physiological reasoning.
35. How and why will the amount and composition of gastric and pancreatic juices change when fats enter the duodenum?
36. How and why will the amount and composition of gastric and pancreatic juices change when cabbage juice enters the stomach?
37. Determine the rate of filtration in the glomeruli, draw a conclusion.
38. Determine the amount of water reabsorption in the nephron. Conclude.
39. Evaluate the results of the study of kidney function according to the method of Zimnytskyi.

8. TEACHING METHODS

1. **Verbal** (lecture, explanation, story, conversation, instruction);
2. **Visual** (observation, illustration, demonstration);
3. **Practical** (various types of exercises, performing graphic works, carrying out an experiment, practice).

The following teaching methods are also used during the educational process:

- **explanatory-illustrative or information-receptive** , which involves the presentation of ready-made information by the teacher and its assimilation by students;
- **reproductive** , which is based on the performance of various tasks according to the model;
- **method of problem presentation**, which is because the teacher poses a problem and solves it himself, demonstrating the contradictions that characterize the learning process, while the students' task is to control the sequence of presentation of the material, the significance of the evidence, predicting the teacher's next steps; this MN is implemented by training students in problem situations with the aim of successful preliminary preparation for future work in real conditions of practical medical institutions;
- **partially search or heuristic** , aimed at mastering individual elements of search activity, for example: the teacher formulates a problem, students - a hypothesis;
- **research** , the essence of which is the teacher's organization of creative research activities of students by posing new problems and problematic tasks.
- methods that ensure **perception and assimilation** of knowledge by students (lectures, independent work, instruction, consultation);
- **methods of applying knowledge and acquiring and consolidating abilities and skills** (practical classes, control tasks);
- **methods of checking and evaluating knowledge, abilities and skills** .

9. CONTROL METHODS

9.1. **Current control** is carried out on the basis of control of theoretical knowledge, skills and abilities in practical classes. The student's independent work is evaluated in practical classes and is a component of the student's final grade. Current control is carried out during training sessions and is aimed at checking students' assimilation of educational material. Forms of current control are:

- a) test tasks with the choice of one correct answer, with the determination of the correct sequence of actions, with the determination of correspondence, with the determination of a certain area on a photo or diagram ("recognition");
- b) individual oral survey, interview;

- c) solving typical situational problems;
- e) control of practical skills;
- e) solving typical problems in physiology.

9.2. The form of final control of study success is conducted in the form of an exam (written, oral) (IV semester).

The semester exam is a form of final control of the student's assimilation of theoretical and practical material from the academic discipline. Final control (exam) is held at the last control session.

Students who have attended all the classroom training sessions provided for by the curriculum in the discipline and have obtained a number of points not less than the minimum (**72 points**) while studying the module are admitted to PC. A student who, for good or no good reasons, missed classes, is allowed to work off the academic debt by a certain specified period.

Forms of final control must be standardized and include control of theoretical and practical training.

10. CALCULATION SCHEME AND DISTRIBUTION OF POINTS RECEIVED BY HIGHER EDUCATION ACQUIRES.

Evaluation of current educational activities . During the assessment of mastery of each topic for the current educational activity, the student is given grades on a 4-point (national) grading scale. At the same time, all types of work provided for by the discipline program are taken into account. The student must receive a grade in each topic. Estimates given on a traditional scale are converted into points. Podsumkov a the grade for the current educational activity is recognized as an arithmetic average (the sum of grades for each class is divided by the number of classes in the semester) and is converted into points for

Table 1.

The maximum number of points that a student can score for the current educational activity for admission to the exam is 120 points.

The minimum number of points that a student must score for the current educational activity for admission to the exam is 72 points. The calculation of the number of points is carried out on the basis of the grades received by the student on a 4-point (national) scale during the study of the discipline, by calculating the arithmetic mean (CA), rounded to two decimal places.

Table 1. Recalculation of the average grade for the current activity into a multi-point scale (for disciplines ending with a Credit)

4-point scale	200-point scale	4-point scale	200-point scale	4-point scale	200-point scale	4-point scale	200-point scale
5	200	4.47	179	3.94	158	3.42	137
4.97	199	4.45	178	3.92	157	3.4	136
4.95	198	4.42	177	3.89	156	3.37	135
4.92	197	4.4	176	3.87	155	3.35	134

4.9	196	4.37	175	3.84	154	3.32	133
4.87	195	4.35	174	3.82	153	3.3	132
4.85	194	4.32	173	3.79	152	3.27	131
4.82	193	4.3	172	3.77	151	3.25	130
4.8	192	4.27	171	3.74	150	3.22	129
4.77	191	4.24	170	3.72	149	3.2	128
4.75	190	4.22	169	3.7	148	3.17	127
4.72	189	4.19	168	3.67	147	3.15	126
4.7	188	4.17	167	3.65	146	3.12	125
4.67	187	4.14	166	3.62	145	3.1	124
4.65	186	4.12	165	3.6	144	3.07	123
4.62	185	4.09	164	3.57	143	3.05	122
4.6	184	4.07	163	3.55	142	3.02	121
4.57	183	4.04	162	3.52	141	3	120
4.55	182	4.02	161	3.5	140	Less than 3	Not enough
4.52	181	3.99	160	3.47	139		
4.5	180	3.97	159	3.45	138		

Assessment of individual student tasks . Points for individual tasks are awarded only under conditions of their successful completion and defense. The number of points awarded for different types of individual tasks depends on their volume and importance, but no more than 10-12 points. They are added to the sum of points scored by the student in classes during the current educational activity. In no case can the total amount for the current activity exceed 120 points.

Assessment of students' independent work . Students' independent work, which is provided for by the topic of the lesson along with classroom work, is evaluated during the current control of the topic in the corresponding lesson. The mastery of topics that are presented only for independent work is checked during the final module control.

Assessment of final control. The maximum number of points that a student can score during the exam is **80 points** .

The final test is considered passed if the student scored at least 60% of the maximum number of points (for a 200-point scale – at least **50 points**) .

Determination of the number of points that the student scored from the discipline : the number of points scored by the student in the discipline is determined as the sum of points for the current educational activity and for the final control (exam).

Conversion of the number of points from the discipline into grades on the EC T C scale and on the four-point (traditional) scale

Subject scores are independently converted to both the EC T C scale and the national grading scale , but not vice versa . **Table 2.**

Table 2. Recalculation of the average grade for the current activity into a multi-point scale (for disciplines ending with an Exam)

4-point scale	120-point scale	4-point scale	120-point scale	4-point scale	120-point scale	4-point scale	120-point scale

5	120	4.45	107	3.91	94	3.37	81
4.95	119	4.41	106	3.87	93	3.33	80
4.91	118	4.37	105	3.83	92	3.29	79
4.87	117	4.33	104	3.79	91	3.25	78
4.83	116	4.29	103	3.74	90	3.2	77
4.79	115	4.25	102	3.7	89	3.16	76
4.75	114	4.2	101	3.66	88	3.12	75
4.7	113	4.16	100	3.62	87	3.08	74
4.66	112	4.12	99	3.58	86	3.04	73
4.62	111	4.08	98	3.54	85	3	72
4.58	110	4.04	97	3.49	84	Less than 3	Not enough
4.54	109	3.99	96	3.45	83		
4.5	108	3.95	95	3.41	82		

Criteria for setting the assessment according to the traditional 4-point and ECTS scale for taking the exam :

Score in points	Rating by national scale	Rating according to the ECTS scale
180-200	Perfectly	A
160 -179	Fine	B
150-159		C
130 -149	Satisfactorily	D
120 -129		E
50 - 119	Unsatisfactorily	FX
0-49		F

Evaluation criteria.

During the evaluation of the mastery of each topic for the current educational activity, the higher education applicant is given grades according to the national (traditional) scale, taking into account the approved evaluation criteria:

- *grade "excellent" (5)* - the student flawlessly mastered the theoretical material of the topic of the lesson, demonstrates deep and comprehensive knowledge of the relevant topic, the main provisions of scientific primary sources and recommended literature, thinks logically and constructs an answer, freely uses the acquired theoretical knowledge when analyzing practical material, expresses his attitude to certain problems, demonstrates a high level of assimilation of practical skills;

- *grade "good" (4)* - the student has mastered the theoretical material of the lesson well, has the main aspects from primary sources and recommended literature, presents it with arguments; possesses practical skills, expresses his thoughts on certain problems, but certain inaccuracies and errors are assumed in the logic of the presentation of theoretical content or in the performance of practical skills;

- rating "satisfactory" (3) - the student has basically mastered the theoretical knowledge of the subject, orients himself in primary sources and recommended literature, but answers unconvincingly, confuses concepts, additional questions cause the student uncertainty or lack of stable knowledge; when answering questions of a practical nature, reveals inaccuracies in knowledge, does not know how to evaluate facts and phenomena, connect them with future activities, makes mistakes when performing practical skills;

- rating "unsatisfactory" (2) - the student has not mastered the educational material of the topic, does not know scientific facts, definitions, hardly orients himself in primary sources and recommended literature, lacks scientific thinking, practical skills are not formed.

Estimates given on a traditional scale are converted into points. The minimum number of points that a student must score for the current academic activity per semester for admission to the exam is 120 points.

METHODOLOGICAL SECURITY

1. Working curriculum in the discipline.
2. Calendar and thematic plans of lectures and practical classes.
4. Sample test tasks for classes.
5. Test tasks before the exam.
6. "Test tasks for taking the state licensing exam "Step-1. General medical training" in physiology . For independent work of students of specialties 222 "Medicine", Electronic edition (published annually with updates, in Ukrainian, Russian and English languages).

RECOMMENDED LITERATURE

BASIC

1. Human physiology. William F. Ganong. Translation from English Lviv: BaK, 2002 - 784 p.
2. Normal physiology / Filimonov V.I. (ed). - K.: Zdorov"ya, 1994. - 607 p.
3. Physiology. Under the editorship V.G. Shevchuk. Tutorial. Vinnytsia: New book. 2005. - 564 p.
4. Physiology. Under the editorship V.G. Shevchuk. Vinnytsia: New book. 2012 - 452 p.
5. Human physiology: in 3 volumes. Translation from English. Ed. R. Schmidt and H. Tevs. - M: Mir, 1996.
6. Textbook of medical physiology / Arthur C. Guyton, John E. Hall. - 10th ed. 2000

7. Medical physiology. – Arthur K. Guyton and John E. Hall. Translation from English M. Logosfera 2008 – 1256 with.

AUXILIARY

1. Berkinblit M.B., Glagoleva E.G. Electricity in living organisms. - M.: Nauka, 1988. - 288 p.
2. Zh. Vartak. Interpretation of an electrocardiogram.: translated. With English - M.: Medicine, 1978. - 152 p.
3. Halperin Y. M., Lazarev P. I. Digestion and homeostasis. - M.: Nauka, 1986.- 304 p.
4. Zhalko-Titarenko V.F. Water-electrolyte exchange and acid-base exchange balance - K.: Zdorov"ya, 1989. - 198 p.
5. Kuznyk B.Y., Barkagan Z.S. Modern ideas about the process of blood coagulation, fibrinolysis and the action of natural anticoagulants // Hematology and transfusion. - 1991. - Vol. 36. - No. 11. - P. 22-25.
6. Kucherenko N.E., Germanuk E.L., Vasiliev A.N. Molecular mechanisms of hormonal regulation of metabolism. - K.: Higher School, 1986. - 248 p.
7. Lymansky Yu.P. Physiology of pain. - K.: Zdorov"ya, 1986. - 96 p.
8. Nathan D.G., Ziff K.A. Regulation of hematopoiesis // Hematology and Transfusiology. - 1994. - No. 2. - P. 3-10.
9. Nozdrachev A.D., et al. Visceral reflexes. - L.: Izd. LSU, 1989. – 168 p.
10. Rosen V.B. Basics of endocrinology. - M.: Izd. Moscow State University, 1994.
11. Simonov P.V. Motivated brain: (Estestvennouachnye osnovy obj psychology). - M.: Nauka.
12. Simon Onov P.V. Emotional brain: (Natural scientific foundations of the general psychology). - M.: Nauka.

Approved:



В.о.Пектора /Acting Rector

Mykhailo SALIUTA