APPROVED
by
the Academic Board of the Institute for Medicine, Ecology and Physical Education at Ulyanovsk State University
May 16th, 2024, Record № 9/260
Chairperson _____ (Victor V. Mashin)
Signature *surname, initials*

COURSE SYLLABUS

Course Title	Normal physiology
Faculty	Faculty of Medicine named after T.Z. Biktimirov
Department	Physiology and Pathophysiology
Year of study	2

Field of study «General Medicine» 31.05.01
name *code*

Specialty/profile -
name

Mode of study full-time
full-time, part time (specify those implemented)

First introduced in the educational process at Ulyanovsk State University **September 1st, 2024**

Updated at the department session: record №_____ of _____
Updated at the department session: record №_____ of _____
Updated at the department session: record №_____ of _____

Course designer

Full name	Department	Job title, Academic Qualification
Gening Tatyana Petrovna	Physiology and Pathophysiology	Head of the department, Dr.Bio.Sci., professor
Abakumova Tatyana Vladimirovna	Physiology and Pathophysiology	Dr.Bio.Sci., associate professor

AGREED by	AGREED by
Head of the department Physiology and Pathophysiology implementing the discipline	Head of the Graduating Department of Hospital Therapy
_____ /Tatyana P.Gening/ *(Signature)* *(surname, initials)* May 14th, 2024	_____ /Marina A. Vise-Khripunova *(Signature)* *(surname, initials)* May 16th, 2024

• 1. COURSE AIMS AND OBJECTIVES:

Course aims:

The course is designed

- to establish new understanding of knowledge about holistic living organism and its parts, the basic laws of functioning and mechanisms of their regulation of the interaction between each other and with environmental factors,

-to improve students capacity to identify on the physiological basis of clinical and physiological methods of research used in functional diagnosis and the study integrative human activity.

The course introduces students to the functions of organ systems, regulatory mechanisms.

Course objectives:

- The course equiips students with the knowledge for formation systematic approach to understanding the physiological mechanisms underlying interaction with environmental factors and implementation of adaptive strategies of the human body, the implementation of the normal functions of the human body from the standpoint of the theory of functional systems;
- The course focuses students the study of the methods and principles of the research assessment of the state regulatory and homeostatic systems of the organism in the experiment, taking into account their applicability in clinical practice;
- The course introduces students to methods of evaluation of human functional state, state regulators and homeostatic in different types of purposeful activity;
- The course contributes to better formation bases of clinical thinking based on the analysis of the nature and structure interorganic and intersystem relations from the position of integrated physiology for future practical activities of the doctor.

2. THE COURSE POSITION WITHIN THE FRAMEWOK OF THE NATIONAL CURRICULUM FOR HIGHER PROFESSIONAL EDUCATIONAL

The course of Normal Physiology refers to the Core Module of the National Curriculum for Higher Professional Educational implemented by the higher educational institution.

The course is based on the previous study of such disciplines as: anatomy, neuroanatomy, histology, embryology, cytology, embryonic development of body tissues, biochemistry is required. Normal physiology acquired are essential for the further study of pathophysiology, clinical pathophysiology, propaedeutics of internal diseases, the basics of functional and laboratory diagnostics, pathological anatomy, clinical pathological anatomy, pathophysiology of extreme conditions, anesthesiology, intensive care resuscitation, forensic medicine, surgical gastroenterology and endoscopy and for state final certification.

3. EXPECTED LEARNING OUTCOMES

The process of studying the discipline aimed at forming skills to the assessment of morphological and functional, physiological conditions and pathological processes in the human body for professional applications (GPC-5)

Code and name of the competence to be developed	**Competence indicator and description of expected learning outcomes**
GPC-5	***On completing the course a student is expected*** ***-to know:*** • to construct knowledge of structure, topography and development of cells, tissues, organs and systems of the body in interaction with their normal function, anatomical and physiological, age-sex and individual characteristics of the structure and development of a healthy and large organism; • to develop understanding of the structure of the human body in relation to

	function, the functional systems of the human body, their regulation and self-regulation when exposed to the external environment is normal; • to develop understanding of physicochemical essence of the processes occurring in a living organism at the molecular, cellular, tissue and organ levels; basic patterns of development and vital activity of the organism based on the structural organization of cells, tissues and organs; • to construct knowledge of histo-functional features of tissue elements, methods of their study. ***-to be able*:** • -to apply educational, scientific, popular science literature, the Internet for professional activities, • -to put into practice physical, chemical and biological equipment; work with magnifying equipment (microscopes, optical and simple loupes); • -to exploit a histophysiological assessment of the state of various cellular, tissue and organ structures; interpret the results of the most common methods of functional diagnostics used to identify pathologies of the blood, heart and blood vessels, lungs, kidneys, liver and other organs and systems; evaluate the results of electrocardiography; spirography; thermometry; hematological indicators; to distinguish in blood serum the normal values of the levels of metabolites (glucose, urea, bilirubin, uric acid, lactic and pyruvic acids, etc.), to register an ECG in experimental animals and humans, to calculate and analyze the leukocyte formula; • -to develop the capacity for determining and evaluating the results of electrocardiography, spirography, thermometry, hematological parameters. ***-to master:*** methods of assessing the physiological state of the patient; methods of physical examination of the patient.

4.COURSE ESTIMATED WORKLOAD

4.1. **Estimated workload in credits -3,5.**

4.2. **Estimated workload in academic hours -252**:

Educational activities	**Academic hours (mode of study: full-time)**		
	Total academic hours	**Term**	
		Term 3	**Term 4**
1	2	3	4
Classroom activities			
Lectures	36	18	18
Workshops and seminars	108	54	54
Laboratory sessions	-	-	-
Independent study	72	54	18
Formative assessment (tests, quizzes, essays etc)	8 colloquiums	3 colloquiums	5 colloquiums
Coursework (Course assignment)	-	-	-

Summative Assessment (exams, tests)	36	credit	exam
Total academic hours	252	126	126

* - *the number of hours spent in an interactive form*

If necessary, you can use in the educational process partially / exclusively distance educational technologies

4.3. Course structure diagram. Allocation of academic hours to types of educational activities:

Mode of study: **full-time**

Sections and topics	Total	Session types					
		Classroom sessions			Interactive sessions	Independent study	Formative assessment
		Lectures	Workshops and seminars	Lab sessions			
1	2	3	4	5	6	7	8
Section 1. Physiology of excitable tissues.							
Topic 1. Subject, research methods and significance of physiology. Basic properties of living things (irritability, excitability).	7	1	3	-	4	3	Test; Oral questioning; Checking of situational tasks
Topic 2. General properties of excitable tissues. Indicators of excitability Bioelectric phenomena in living systems	8	2	3	-	4	3	Test; Oral questioning; Checking of situational tasks
Topic 3. Types of muscle contraction. Reduction mechanism. Muscle physiology.	8	1	3	-	4	4	Test; Oral questioning; Checking of situational tasks
Topic 4. Physiology of muscles. Muscle strength and work.	8	1	3	-	4	4	Test; Oral questioning; Checking of situational tasks

Exhusion							
Topic 5. Properties of peripheral nerves and myoneural synapses	8	1	3	-	4	4	Test; Oral questioning; Checking of situational tasks
Topic 6. Final lesson “General properties of excitable tissues. Neuromuscular physiology "	3	-	3	-	4	4	Test; Oral questioning; Checking of situational tasks
Section 2. Physiology of the Central Nervous System							
Topic 7. Reflex as the main form of nervous activity. Reflex arc analysis.	8	1	3	-	4	4	Test; Oral questioning; Checking of situational tasks
Topic 8. Properties of nerve centers. Features of the conduction of excitation in the nerve centers. General principles of coordination activities in the central nervous system	8	1	3	-	4	4	Test; Oral questioning; Checking of situational tasks
Topic 9. The process of inhibition in the central nervous system.	8	1	3	-	4	4	Test; Oral questioning; Checking of situational tasks
Topic 10. Spinal cord and its functions	8	2	3	-	4	3	Test; Oral questioning; Checking of situational tasks

Topic 11. Brain stem: medulla oblongata, pons varoli. Brain stem reflexes.	7	1	3	-	4	3	Test; Oral questioning; Checking of situational tasks
Topic 12. Midbrain, reticular formation. The cerebellum and its functions.	7	1	3	-	4	3	
Topic 13. The diencephalon and its functions. Physiology of the autonomic nervous system	7	1	3	-	4	3	Test; Oral questioning; Checking of situational tasks
Topic 14. Final lesson "Physiology of the Central nervous system".	7	1	3	-	4	3	Test; Oral questioning; Checking of situational tasks
Section 3. Physiology of analyzers, higher nervous activity.							
Topic 15. Physiology of analyzers. Visual analyzer	8	1	3	-	4	4	Test; Oral questioning; Checking of situational tasks
Topic 16. Physiology of analyzers (auditory, vestibular, somatosensory, olfactory, gustatory analyzers)	8	1	3	-	4	4	Test; Oral questioning; Checking of situational tasks
Topic 17. Neurophysiological features of the human brain. The method of	9	2	3	-	4	4	Test; Oral questioning; Checking of

developing a conditioned reflex. Cortical inhibition. Higher mental functions of a person							situational tasks
Topic 18. Final lesson "Physiology of analyzers. Higher nervous activity "	3	-	3	-	3	-	Test; Oral questioning ; Checking of situational tasks
Section 4. Visceral functions							
Topic 19. Physiology of blood circulation. Physiology of the heart. The main properties of the heart muscle.	5	1	3	-	4	1	Oral questioning
Topic 20. Physiology of blood circulation. Physiology of the heart. Phases of the cardiac cycle. Regulation of the activity of the heart. Methods for studying the activity of the heart.	7	2	3	-	4	2	Test; Oral questioning; Checking of situational tasks
Topic 21. Physiology of blood circulation. Physiology of the heart. Blood pressure. Regulation of vascular tone.	7	2	3	-	4	2	Test; Oral questioning; Checking of situational tasks
Topic 22. Final lesson: “Physiology of blood circulation. Physiology of the Heart ".	3	-	3	-	3	-	Test; Oral questioning;

Topic 23. Breth Physiology. External respiration. Gas exchange in the lungs. Transport of gases by blood. Respiration regulation.	7	2	3	-	4	2	Oral questioning
Topic 24. Final lesson on "Breth Physiology"	3	-	3	-	-	-	Oral questioning
Topic 25. Physiology of digestion. Methods for studying the functions of the gastrointestinal tract. Digestion in the oral cavity. Digestion in the stomach.	5	1	3	-	4	1	Test; Oral questioning; Checking of situational tasks
Topic 26. Physiology of digestion. Digestion in the intestines. Pancreas and liver functions. Motility of the gastrointestinal tract and its regulation. Absorption in various parts of the gastrointestinal tract.	7	2	3	-	4	2	Test; Oral questioning; Checking of situational tasks
Topic 27. Final lesson in the section: "Physiology of digestion."	3	-	3	-	3	-	Oral questioning
Topic 28. Physiology of excretion. Clinical methods for the study of renal function.	5	1	3	-	4	1	Test; Oral questioning; Checking of situational tasks

Regulation of kidney function.							
Topic 29. Physiology of the endocrine glands	5	1	3	-	4	1	Test; Oral questioning; Checking of situational tasks
Topic 30. Metabolism and energy. Main and working exchange. Thermoregulation	7	2	3	-	4	2	Test; Oral questioning ; Checking of situational tasks
Topic 31. Final lesson in the sections: "Excretion", "Metabolism", "Endocrinology", "Thermoregulatio n".	3	-	3	-	3	-	Oral questioning
Topic 32. Physiology of blood. Corpuscular elements of blood. Physiology of erythrocytes. Respiratory function of blood.	5	1	3	-	4	1	Test; Oral questioning; Checking of situational tasks
Topic 33. Physiology of blood. Physiology of leukocytes. Physicochemical properties of blood.	6	2	3	-	4	1	Test; Oral questioning; Checking of situational tasks
Topic 34. Physiology of blood. Clotting of blood. The doctrine of blood groups.	7	2	3	-	4	2	Test; Oral questioning; Checking of situational tasks
Topic 35. Final lesson "Blood	3	-	3	-	3	-	Oral questioning

Physiology"							
Topic 36. Lesson on practical skills.	4	-	3	-	3	1	Oral questioning
Total:	252	36	108	-	144	72(54/18)	

Used interactive educational technologies

The following educational technologies are used in conducting classroom studies: lectures and practical exercises. When organizing classes in an active and interactive form, information technologies, computer simulation programs “Virtual Workshop on Human and Animal Physiology”, situational tasks and tests are used, in discussing the results of which the discussion technology is used: brainstorming technology is used when studying new theoretical material before performing practical assignments.

5. COURSE CONTENTS

Section 1. Principles of functioning of individual organs and systems

Topic 1.1. Introduction. General physiology and biophysics of excitable tissues.

The contribution of Russian physiologists in the world physiological sciences (A. M. Filomafitsky, I. Glebov, F. V. Ovsyannikov, I. M. Sechenov, N. A. Mislavsky, I. P. Pavlov, N. E. Vvedenskii, A. A. Ukhtomsky, A. F. Samoilov, L. A. Orbeli, P. K. Anokhin, K. M. Bykov, E. A. Asratyan, V. V. Parin, V. N. Chernihivovskiy, L. S. Shtern, etc.). The deepening of the analytical division. Human physiology and scientific-technical progress. Physiology as a scientific basis for the diagnosis of health, healthy lifestyle and foresight of functional status and human performance. A systematic approach to the study of purposeful human behavior in the natural environment, the conditions of industrial labor, sports and other species of activity. The study of the influence of social factors on the life processes of a human organism. Cell. Its function. Body tissues (epithelial, connective, muscular and nervous), the main special features of their functions. The concept of irritability and excitability. Indicators of excitability, curve "force - time"

Topic 1.2. Bioelectric phenomena in living systems.

The resting potential (PP). The action potential (AP). Modern ideas about the process of excitation. The ratio between of excitability phases and phases of PD. The effect of DC on the tissue. Characteristic of connective tissue with low excitability (connective, bone, cartilage). Biopotentials of glandulocytes. The secretory cycle.

Topic 2. Physiology of nerve fibers, nerves and muscles.

Fiber type A, B, C. Features of conduction of the excitation along the nerve fibers and at nerve trunks. The parabiosis (N. E. Vvedensky).

Topic 2.1. Physiology of muscles Functional characteristics of muscle tissue. The mechanism of muscle contraction. Physiology of smooth muscle.

Topic 3. General physiology of the central nervous system. Structure and properties of synapses.

The role of the central nervous system in an integrative adaptive activity of the body. The blood-brain barrier. Research methods of CNS functions. The reflex principle of the activity of nervous system. The structure of the reflex arc. Integrative activity of the neuron. Properties of receptors, the mechanism of their excitation. Functional property of synapses. Features of the structure and classification. The physiological meaning of the doctrine of the regulation functions for general medicine and clinical disciplines, for forming concepts about health and healthy lifestyles.

Topic 3.1. The transfer of excitation synapses. EPSP, IPSP. Properties of the nerve centers.

Mechanisms of transmission of excitation. Neurotransmitter theory. Postsynaptic potentials. The concept of nervous center. Physiological properties of the nerve centers.

Topic 4. Inhibition of the nerve centers. Coordination of reflex activity. Modern views on the mechanism of central inhibition. The main types of the inhibition and its role. General principles of coordination. The interaction between the processes of excitation and inhibition as the coordination of reflexes. The iconic function of the brain: gnosis, praxis.

Topic 5. Physiology of the spinal cord, brainstem and cerebellum.

Characterization of spinal animals. Spinal shock. Bell - Majandi law. The centers of the spinal cord. Conducting function of the spinal cord. The centers of the medulla oblongata and the pons. Conducting function of the medulla oblongata. Tonic reflexes of the brain stem Reflex activity of the midbrain. Cerebellum and its afferent and efferent connections. The interaction between the cortex and nuclei of the cerebellum. Anti-gravity function of the cerebellum.

Topic 6. Physiology of the reticular formation

Features of neural organization. Connection of the reticular formation with the conductive paths of the brain. Upstream and downstream influences of the reticular formation.

Topic 7. Physiology of the diencephalon, limbic system and basal nuclei. Physiology of the autonomic nervous system.

The thalamus - the collector of afferent pathways. Functional characterization of associative and non-specific nuclei.

Topic 7.1. Physiology of the autonomic nervous system**.**

Structural and functional characteristics of the autonomic innervation. Visceral and autonomic ganglia. The influence of the sympathetic and parasympathetic divisions of the ANS to the innervated organs. Autonomic centers. Patterns of autonomic reflexes. Role of the autonomic nervous system in the integration of functions in the formation of holistic behavioral acts.

Topic 8. Physiology of the heart.

Physiological properties of cardiac muscle. Cardiac cycle and its phases. Hemodynamic functions of the heart.

Topic 8.1. Methods of assessment of cardiac activity

The heart tones. Phono- and electrocardiography.

Topic 9. The regulation of heart activity. Autoregulation, neural, humoral regulation. Reflexes of the heart. Integration of mechanisms that regulate heart function.

Topic 10. The basic laws of hemodynamics blood flow regulation.

The basic laws of hemodynamics. The changes of blood pressure, resistance and velocity of blood flow in different parts of the bloodstream. Arterial and venous pulse.

Topic 10.1. Blood flow regulation.

Microcirculation. Regional circulation. Methodology of the study of organ blood flow (occlusive, plethysmography, ultra-sound and electromagnetic flowmetry). Methods of investigation of microcirculation. Vasomotor center, vasomotor nerves. Neural and humoral influences on vascular tone. Pressor and depressor reflexes. The base tone. Features and regulation of capillary blood flow. Functional features of the pulmonary circulation, coronary blood flow. Factors of a healthy lifestyle, which prevent disturbance of the circulatory system. Age peculiarities of the circulatory system. The change of organ blood flow during muscular exertion, eating, pregnancy, hypoxia, stress and other conditions.

Topic 11. The lymphatic system, its structure and functions. Chylopoiesis and mechanisms of its regulation. The factors for lymph circulation and the mechanisms of its regulation.

Topic 12. Physiology of respiration. External respiration. The mechanism of inhalation and exhalation. The stages of the breathing process.

The mechanism of inhalation and exhalation. The pressure in the pleural cavity. The elastic properties of the lungs. Spirometry, spirography, pneumotachography.

Topic 13. Digestion in the stomach, duodenum, small intestine and colon. Motility and absorption**.** Digestion in the stomach. The exocrine activity of the pancreas. Regulation of pancreatic secretion. Role of the liver in digestion. Digestion in the jejunum and the ileum.

Cavity and membrane hydrolysis. Digestion in the large intestine. The significance of microflora and gas in the intestines. Motility and absorption in different parts of the gastrointestinal tract.

Topic 14. Metabolism and energy. Physiology of metabolism and energy.

Plastic and energy role of the nutrients. Caloric and respiratory factors. Basal and active metabolic rate. The concept of water balance. Energy expenditure of the body in different kinds of work. Age peculiarities of the system of metabolism. Physiological fundamentals of nutrition.

Topic 14.1. Thermoregulation.

Systemic mechanisms of the thermoregulation and heat transfer. Mechanisms of hardening of the body. Age peculiarities of the system of thermoregulation.

Topic 15. Physiology of the urinary system

The main processes occurring in the kidney: filtration, secretion. Regulation of urine formation and urination. Adaptive changes of renal function in different environmental conditions. The skin as an excretory organ. The functions of sebaceous and sweat glands, regulation of their activities. Non-excretory functions of the skin.

Topic 16. Physiology of the endocrine glands

Physiology of the endocrine glands and their role in the formation of functional systems of the organism. The mechanism of action of hormones. Methodology of the study of the endocrine glands. The hypothalamic-pituitary system. Thyroid gland. Parathyroid gland. Endocrine function of the pancreas. The adrenal glands. The sex glands. The epiphysis. The thymus gland. Age features of the endocrine system.

Topic 17. Blood physiology

Basic constants of blood and self-regulatory mechanisms of maintaining. Protective functions of blood. The blood group. RH factor. Mechanisms of blood coagulation. Lymph, its composition, quantity, functions, physiological significance. Extravascular fluid environment of the body (interstitial, spinal, synovial, pleural, peritoneal, liquid medium of the eyeball, slime) and their role to provide vital activity of the cells of the body.

Topic 17.1. The body and its defense system.

The factors ensuring the integrity of the organism. Barriers of external and internal environment of the body. Immunity and its types. Protective reflexes.

Topic 18. Physiology of analyzer systems.

The doctrine of I. P. Pavlov about the analyzers. The role of different types of afferentation in the formation of functional systems of an organism. Classification of receptors. Methods of studying the excitability of the receptors. Acupressure points and the principle of reflexology.

Section 2. Functional systems of the human body, their regulation and self-regulation when exposed to the external environment

Topic 19. The doctrine of functional systems.

System organization of functions. Nodal mechanisms of the functional system.

Topic 20. Transport of gases by blood.

Functional system, providing optimum level of gases for metabolism. Transport of gases by blood. Dissociation curve of oxyhemoglobin. The composition of inhaled, exhaled and alveolar air. The respiratory center. Automaticity of RC. Peripheral and central chemoreceptors. Impact of gas composition on RC: pH of blood and cerebrospinal fluid. Regulation of respiration by the hypothalamus, limbic system and cortex. Functional respiratory system. Age peculiarities of the respiratory system.

Topic 20.1. Functional system, providing optimum for metabolism level gases. Functional respiratory system. Age peculiarities of the respiratory system.

Topic 21. Functional digestive system and the place of digestive processes in it.

Food motivation. Physiological basis of hunger and satiety. Digestion in the mouth. Swallowing, its phases, the methodology of the study, regulation.

Topic 21.1. Food motivation. Physiological basis of hunger and satiety.
Food motivation. I.P. Pavlov about the food centre. Regulation of feeding behavior. Age peculiarities of the digestive system.
Topic 22. Higher nervous activity. Conditional reflexes.
Objective methods of studying GNI (I. P. Pavlov). Regularities of formation and existence of conditional reflexes. Mechanisms of formation of temporary connections. Architecture of a holistic behavioral act (P. K. Anokhin).
Topic 22.1. The adaptation of the body to the personal conditions of existence.
Bioecology (chronobiology). The idea of discrete time-personal processes in the body. Cyclic processes. Physiology of adaptation. Individual adaptation. Types, phases and criteria of adaptation.
Topic 22.2. Purposeful behavior.
Purposeful behavior as a form of behaviour that leads to the achievement of the body's adaptive result. Physiological basis of employment. Features of physical and mental work.
Topic 22.3. The problem of fatigue of the whole organism**.**
Active leisure (I. M. Sechenov) and its mechanisms. Optimal conditions for work and leisure as the basis for a long period of high working ability of the body. Age features of purposeful behavior.
Topic 23. The phenomenon of inhibition in the higher nervous activity. Types and mechanisms of inhibition of HNA. Physiology of sleep. Physiological basis of hypnotic states.
Topic 24. Types of HNA. The doctrine of the 1st and 2nd signal systems. Memory.
The doctrine of I. P. Pavlov about the types of HNA. Methods for determination of HNA. The power relationships law and its changes in different functional states of the organism. Attention. Perception. Emotions and their biological role. Memory, its types and mechanisms. Thinking. Consciousness. Speech.
Topic 25. Physiology of the reproductive system.
The stage of reproduction. Anatomical and physiological basis of reproduction. The formation and mechanisms of sexual motivation. Phase of the sexual cycle in men. Features of the phases of the sexual cycle in women.
Topic 26. Physiology of pain and pain relief.
The pain as the feeling and condition. Nociception. Antinociception. Physiological mechanisms of pain and analgesia.
Topic 27. Practical skills.
Determination of the number of erythrocytes in the blood
Determination of hemoglobin content in blood by the method of Sahli
The calculation of the color index of blood
Determination of the erythrocyte sedimentation rate by Panchenkov`s method
Determination of the number of leukocytes in the blood
Observation of different types of hemolysis
Determination of osmotic resistance
Determination of blood groups
Determination of Rh
Determination of coagulation time
Determination of bleeding time by Duke
Listening to heart tones.
Definition of blood pressure by the method of Korotkov.
The ECG recording.
Palpation of the pulse.
Measurement of the vital capacity of the lungs and its components.
Pneumography.

Calculation of basal metabolic rate.
The study of the reaction time.
Dynamometry.
Assessment of the field of view.
Assessment of visual acuity.
Research methods of taste sensitivity.

6. TOPICS OF WORKSHOPS AND SEMINARS

Section 1. Patterns of functioning of individual organs and systems

Section 1. Patterns of functioning of individual organs and systems

Topic 1. Subject and methods of research in physiology. The basic properties of the living (irritability, excitability, metabolism). General properties of excitable tissues.
Topic 2. Bioelectric phenomena in living systems.
Topics 3-4. Types of muscular contraction. The contraction mechanism. Physiology of muscles. Force and muscle work. Exhaustion.
Topic 5. Properties of peripheral nerves and neuromuscular synapses.
Topic 6. The final lesson on the topic: General properties of excitable tissues. Neuromuscular physiology.
Topic 7. Reflex as the basic form of nervous activity. The reflex arc. Its analysis.
Topic 8. Features of the conduction of excitation and the general principles of coordination in the central nervous system.
Topic 9. Spinal cord, the medulla oblongata and their functions.
Topic 10. The midbrain, the cerebellum, the diencephalon, their functions. Physiology of the autonomic nervous system.
Topic 11. The final session on the theme: Physiology of the central nervous system.
Topic 12. Physiology of blood circulation. Basic properties of cardiac muscle.
Topic 13. Physiology of blood circulation. Regulation of cardiac activity.
Topic 14. Physiology of blood circulation. Phases of the cardiac cycle. Research methods of cardiac activity.
Topic 15. Physiology of blood circulation. Blood pressure. The regulation of vascular tone.
Topic 16. The final lesson on the topic: Physiology of blood circulation
Topic 17. Physiology of respiration. External respiration. Gas exchange in the lungs. Transport of gases by blood.
Topic 18. Physiology of respiration. Control of breathing.
Topic 19. The final lesson on the topic: Physiology of respiration.
Topic 20. . The physiology of digestion. Methods of study of the gastrointestinal tract. Digestion in the oral cavity.
Topic 21. The physiology of digestion. Digestion in the stomach and intestines. The function of the pancreas and liver.
Topic 22. The physiology of digestion. The motility of the gastrointestinal tract and its regulation. The physiology of digestion. Absorption in different parts of the gastrointestinal tract.
Topic 23. The final session on the theme: Physiology of digestion.
Topic 24. Blood physiology. Hemocytes. Physiology of red blood cells. Respiratory function of the blood.
Topic 25. Blood physiology. Physiology of leukocytes. Physico-chemical properties of blood.
Topic 26. Blood physiology. Coagulation of blood. The doctrine of the blood groups.
Topic 27. The final session on the theme: Physiology of blood.
Topic 28. Metabolism and energy. Basal and active metabolism.
Topic 29. Physiology of the endocrine glands.

Topic 30. Physiology of excretion. Clinical methods of research of function of kidneys. Regulation of kidney function.
Topic 31. The final session on topics: Metabolism. Endocrinology. Thermoregulation. Excretion.
Topics 32-33. Physiology of analyzers.
32.1. Visual analyzer.
32.2. Auditory analyzer.
32.3. Vestibular analyzer.
32.4. Skin analyzer.
32.5. Taste analyzer.
Topic 34. HNA. Functions of the cerebral cortex. Methodology the elaboration of a conditioned reflex. Cortical inhibition. Higher mental functions.
Topic 35. The final session on topics: HNA. The analyzers.
Topic 36. Test session on practical skills.

7. LABORATORY SESSIONS

This type of sessions is not provided by the Curriculum

8.TOPICS OF COURSE ASSIGNMENTS,TESTS AND ESSAYS

This type of sessions is not provided by the Curriculum

9. CREDIT QUESTIONS

1. Subject of physiology and classification of physiological disciplines.
2. Relation of physiology with other sciences.
3. Value of a normal physiology course for medicine.
4. Notion of excitability.
5. Excitability indicators.
6. Law of the power relations.
7. Law “everything or nothing”.
8. Membrane potential, its origin and properties
9. Action potential, its origin and properties
10. Local respond and its characteristic
11. Curve of excitability and origin of its phases
12. Effect of a direct current on tissue
13. Concept about a motor and neuromotor unit.
14. Physiological properties of muscles.
15. Irritation of muscles and ways of registration.
16. Single muscular contraction.
17. Change muscle fiber excitability at its reduction.
18. Summation and tetanus. Optimum and pessimum of muscular contraction.
19. Modern theory of muscular contraction and relaxation.
20. Force and muscle work.
21. Exhaustion of the isolated muscle and exhaustion in the whole organism.
22. Adaptation and trophic influence of sympathetic nervous system on skeletal muscles.
23. Heat generation at excitement and contraction of muscles.

24. Physiological features of smooth muscles.
25. Differences of the smooth muscle from the skeletal muscle.
26. Classification of nervous fibers.
27. Distribution of excitement on myelin and non-myelin nervous fibers.
28. Laws of excitement conduction on nervous fibers.
29. Synapse. Structure, classification. Excitement transfer mechanism.
30. Concept of the central nervous system. Definition of a reflex.
31. Structure of a reflex arch.
32. The neuron is a structurally functional unit of CNS`.
33. Features of excitement emergence in neuron.
34. Mechanisms of excitement emergence in receptors.
35. Definition and types of inhibition in CNS`.
36. Postsynaptic inhibition.
37. Presynaptic inhibition.
38. Sechenov Central inhibition.
39. Simple inhibition chains.
40. Spinal cord. Conduction and reflex functions.
41. Functions of ventral and dorsal roots of a spinal cord.
42. Segmental and intersegmental principle of a spinal cord.
43. Spinal shock.
44. Medulla. Bulbar animal.
45. Conduction function of a medulla oblongata.
46. Reflex function of a medulla oblongata.
47. Tonic reflexes of the brainstem.
48. Reticular formation of the brainstem.
49. Midbrain. Conduction function of midbrain.
50. Reflex activity of midbrain.
51. Cerebellum and its function.
52. Hypothalamus. Hypothalamus participation in the regulation of autonomic functions.
53. Thalamus. Functional characteristics of major nuclear groups.
54. Comparative characteristics of the sympathetic and parasympathetic divisions of the autonomic nervous system. The synergy and antagonism of their relative influence.
55. Definition of the analyzer according to I.P.Pavlov. Functions of the analyzer.
56. Visual analyzer
57. Receptor apparatus. Photochemical processes in a retina
58. Conduction part of the visual analyzer
59. Cortical representation of the visual analyzer
60. Accommodation. Visual field. Visual acuity
61. Acoustic analyzer. Structure. Functions.
62. Vestibular analyzer. Structure. Functions.
63. Somatosensory analyzer
64. Taste analyzer
65. Olfactory analyzer
66. Concept of reflex. Classification of reflexes.
67. Rules of development of conditioned reflexes.

68. The scheme and mechanisms of short circuit of temporary communications at development of conditioned reflexes
69. Types of higher nervous activity. The doctrine about the first and second alarm systems.
70. Inhibition in HNA.
71. Concept of dominant (A.A. Ukhtomsky).

EXAM QUESTIONS.

1 The main stages of development of physiology.
2 The contribution of I. P. Pavlov in the development of the russian physiology.
3 Features of the modern period of physiology development.
4 The reflex principle of nervous system activity (R. Descartes, P. Prochazka), its development in the works of I. I. Sechenov, I. P. Pavlov, P. K. Anokhin.
5 Analytical and systematic approaches to the study of body functions.
6 Humoral regulation, characteristics and classification of physiologically active substances. The relationship of the nervous and humoral mechanisms of regulation.
7 The Anokhin's theory of functional systems and self-regulation of functions. Nodal mechanisms of the functional system.
8 Irritability, excitability as the basis of tissue responses to stimulation. Stimuli, their types and characteristics.
9 Modern ideas about the structure and function of membranes. Active and passive transport across membranes.
10 Electrical phenomena in excitable tissues. The history of their discovery.
11 Membrane potential and its origin.
12 The action potential and its phase. The ratio of phases of excitability with the phases of the action potential.
13 Excitability, methods of its evaluation.
14 Single contraction and its types. Tetanus. The factors that influence its value. The optimum and pessimum irritation.
15 Tetanus and its types.
16 The modern theory of muscle contraction and relaxation.
17 The evaluation of the force of muscle contraction. Dynamometry.
18 The spread of excitation on non-myelinated and myelinated fibers. Features of their excitability and lability.
19 Features of the structure and functioning of smooth muscles.
20 The structure and classification of synapses. The mechanism of conduction of excitation in the synapses (electrical and chemical).
21 Features of the structure and conduction of excitation in nerve-muscle synapses. Neurotransmitters, their synthesis, secretion, interaction with receptors.
22 Neuron as structural and functional unit of the CNS, its physiological properties and relationship to glial cells.
23 Features of the conduction of excitation in the synapses of the CNS. Excitatory synapses and a variety of mediators in the CNS (EPSP).
24 General principles of coordination of activity of the central nervous system.
25 Properties of the nerve centers.
26 Structural-functional features of somatic and autonomic nervous system.
27 Inhibition in the CNS (I. M. Sechenov), its types and role. Modern concepts of the mechanisms of central inhibition.
28 The main principles and peculiarities of propagation of excitation in the central nervous system. Convergence, divergence, unilateral conduct.

29 Characterization of spinal animals. Spinal reflexes.

30 The medulla oblongata and the pons, their participation in the processes of self-regulation functions. The centers of the medulla oblongata.

31 Decerebration rigidity and the mechanism of its occurrence.

32 Physiology of the cerebellum, its influence on the motility and autonomic functions of the body.

33 Reticular formation of brain stem. Ascending activating effects on the cerebral cortex (G. Magoun, D. Moruzzi).

34 The hypothalamus. Characteristics of the main nuclear groups. Part of the hypothalamus in regulation of autonomic functions and in the formation of emotions and motivations.

35 The thalamus. Functional characterization of the major nuclear groups.

36 Comparative characteristics of the sympathetic and parasympathetic divisions of the autonomic nervous system, the synergy and the relative antagonism of their influence.

37 A stereotactic method and its importance for the study of the functions of the central nervous system.

38 The theory of I. P. Pavlov about the analyzers.

39 Characteristics of the visual analyzer. Receptor apparatus. Photochemical processes in the retina by the action of light.

40 Adaptation of analyzers, its peripheral and central mechanisms.

41 Auditory analyzer. The mechanism of occurrence of the receptor potential in hair cells of the spiral ganglion. Theory of perception of sounds (G. Helmholtz, G. Bekesy).

42 Features of conductor and cortical parts of the auditory analyzer.

43 Receptor apparatus of analyzers. Classification, functional properties and features jf receptors

44 The vestibular analyzer.

43 Conductive part of the visual analyzer. Features of chiasm optic tract.

46 Theory of color perception (M. V. Lomonosov, G. Helmholtz, Hering)

47 Biological significance of pain. The modern idea of the nociception and central mechanisms of pain. Antinociceptive system.

48 Methods of studying the function of the visual analyzer (visual field, visual acuity, color vision).

49 Classification of reflexes. Reflex path. Reverse afferentation. The concept of the adaptive result.

50 Alteration of motor function in lesions of the cerebellum in humans.

51 Physiological mechanisms of conditioned reflexes formation, their structural-functional basis. Development of ideas of I. P. Pavlov on the mechanisms of formation of temporary connections.

52 Conditioned reflex as a form of adaptation of animals and humans to the changing conditions of existence. Classification of conditional reflexes.

53 The mechanism of formation of conditioned reflexes.

54 Conditioned reflex. Development of ideas of I. P. Pavlov on the mechanisms of formation of temporary connections.

55 The doctrine of I. P. Pavlov on I and II signalling systems.

56 The doctrine of I. P. Pavlov about the types of higher nervous activity. Types of inhibition.

57 The modern idea of localization of functions in the cerebral cortex of the brain. Polyfunctionality of cortical regions.

58 Functional asymmetry of the brain.

59 Congenital form of behavior (unconditioned reflexes and instincts) and its importance for adaptive activities.

60 Dynamic stereotype, its physiological nature, importance.
61 Physiological mechanisms of sleep. Sleep phases. Sleep theory.
62 Modern ideas about the functional organization of the brain.
63 The concept of metabolism in the body. The processes of assimilation and dissimilation of substances. Plastical and energy role of nutrients.
64 The heat production. Metabolism as a source of heat production. The role of individual organs in the heat production.
65 The heat transfer. Methods of heat transfer from the body surface. Physiological mechanism of heat transfer.
66 Basis of preparation of diets.
67 Methods for determining energy expenditure. Direct and indirect calorimetry.
68 Definition of respiratory quotient, its value for calculation of power consumption.
69 The basal metabolic rate and importance of its calculation for the clinic.
70 Chamber (closed) methods for evaluation of energy expenditure (N. M.Shaternikov).
71 The energy balance of the body. Active metabolism. Energy expenditure of the body in different kinds of work.
72 The value of mineral substances, microelements and vitamins in the body.
73 Digestion in the mouth. Composition and physiological role of saliva. Salivation, its regulation.
74 Methods of research of the gastrointestinal tract in animals and humans.
75 Ignition (delicious) gastric juice and its value.
76 Methods of study of bile formation and biliary excretion.
77 Digestion in the stomach. The composition and properties of gastric juice. Regulation of gastric secretion. Phase separation of the gastric juice.
78 Motor and evacuation function of the stomach, its regulation.
79 The absorption of substances in different parts of the gastrointestinal tract. Types and mechanism of absorption of substances through biological membranes.
80 Cavity and membrane hydrolysis of nutrients in different parts of the small intestine.
81 Food motivation. Physiological basis of hunger and satiety.
82 Role of the liver in digestion. The production of bile and its role in digestion.
83 Methods of study of salivation in animals and humans (I. P. Pavlov, N. I.Krasnogorskyi).
84 Digestion in duodenum. The exocrine activity of the pancreas. Regulation and adaptive nature of the pancreatic secretion to the types of food and food rations.
85 Features of digestion in the colon.
86 The composition and properties of intestinal juice. Regulation of secretion of intestinal juice.
87 Endocrine function of the gastrointestinal tract.
88 Methods of investigation of motor function of the gastrointestinal tract in humans and animals.
89 Hormones of the pituitary gland, its functional connectivity with the hypothalamus and role in the regulation of activity of endocrine organs.
90 Physiology of the adrenal glands. The role of hormones of the adrenal cortex in the regulation of body functions.
91 Methods of studying the functions of the endocrine glands.
92 Physiology of the thyroid and parathyroid glands.
93 The composition of the blood. Basic physiological constants of blood and the mechanism of their maintenance.
94 Electrolyte composition of blood plasma. The osmotic pressure of blood. Functional system, ensuring the constancy of the osmotic pressure of blood.
95 Principles of manufacturing a blood-substituting solutions.

96 Humoral regulation of erythro - and leukopoiesis.

97 The concept of hemostasis. The process of blood clotting and its phases. Factors accelerating and slowing blood clotting.

98 Characterization of the formed elements of blood (erythrocytes, leukocytes, platelets), their role in the body.

99 Methods for counting erythrocytes and leukocytes.

100 The blood group. RH factor. A blood transfusion. Blood-substituting solutions.

101 Plasma proteins, their characterization and functional significance. The oncotic pressure of blood and its role.

102 The concept of the blood system, its properties and functions.

103 Method for the determination of the RH factor.

104 Oxygen transport in the blood. Dissociation curve of oxyhemoglobin, its description.

105 The transport of carbon dioxide by the blood. The importance of carbonic anhydrase.

106 Calculation of color index of blood.

107 Leukocytes and their types. Leukocyte formula. The functions of the various types of leukocytes.

108 The red blood cells, their functions. Types of hemoglobin and its compounds, their physiological significance.

109 Functional system that supports the constancy of acid-base balance.

110 Coagulation, anticoagulation and fibrinolytic systems of blood, as main functional units of the system maintain its liquid state.

111 Determination of ESR.

112 Study of osmotic resistance of erythrocytes.

113 Lymph, its composition, functions.

114 Regulation of the level of glucose in the blood.

115 Physiological properties and characteristics of the myocardium. Automatism of the heart. Modern ideas about substance, the nature and gradient of automatie.

116 Heart, the value of its chambers and valve apparatus, the pressure variation and blood volume in the cavities of the heart in different phases of the cardiac cycle. Systolic and minute volume of blood.

117 Electrocardiography. Vectorcardiography.

118 The ratio of excitation, contraction and excitability of the heart in different phases of the cardiac cycle. The response of cardiac muscle to additional irritation. Extrasystoles.

119 Heart sounds and their origin.

120 Regulation of cardiac activity (myogenic, humoral, nervous).

121 Humoral regulation of heart activity.

122 Reflex regulation of the heart activity. Characterization of the effects of parasympathetic and sympathetic nerve fibers on the heart.

123 Principles of analysis of the electrocardiogram.

124 Electrocardiogram and its clinical significance.

125 Phase analysis of the cardiac cycle.

126 Blood pressure in different parts of the circulatory system. The factors that determine its magnitude. Types of blood pressure.

127 Reflex regulation of systemic blood pressure. The value of vascular reflex zones. Vasomotor center.

128 The basic laws of hydrodynamics and using them to explain the movement of blood through the vessels. The factors responsible for the movement of blood through the vessels.

129 Capillary blood flow and its features. Microcirculation and its role in the mechanism of fluid exchange and different substances between blood and tissues.

130 Reflex regulation of vascular tone, vasomotor center.

131 Arterial and venous pulse, their origin. Analysis of sphygmogram and phlebogram.
132 Hormones of the adrenal medulla.
133 Bloodless method of determining blood pressure (S. Riva-Rocci, I. S. Korotkov).
134 Breath, its main stages. The mechanism of external respiration. Biomechanics of inhalation and exhalation.
135 Methods of determining lung capacity. Spirometry, spirography.
136 The mechanism of respiratory failure in pneumothorax.
137 Basic physiological mechanisms of respiratory changes during climbing to an high altitude.
138 Gas exchange in the lungs. Partial pressure of gases O_2 and CO_2 in the alveolar air and the tension of gases in the blood.
139 Functional system that provides constant gas composition of blood.
140 Reflex regulation of respiration. The mechanism of change of the respiratory phase.
141 Regulatory influence on the respiratory center from the higher parts of the brain (the hypothalamus, the cortex).
142 The role of humoral factors in the regulation of respiration. The role of carbon dioxide. The mechanism of the first breath of a newborn baby.
143 The pressure in the pleural cavity, its origin and significance in different phases of the respiratory cycle.
144 Definition of minute ventilation of the lungs in different conditions.
145 The respiratory center (N. I. Mislavsky). Modern views on its structure and localization. Nervous and humoral regulation of the respiratory center.
146 Nephron structure, blood supply. The mechanism of formation of primary urine, its composition.
147 The formation of the final urine, its composition and properties. Reabsorption in the tubules, the mechanism of its regulation. The processes of secretion and excretion in the renal tubules.
148 The formation of primary urine.
149 The process of urination, its regulation.
150 The regulation of activity of the kidneys. The role of neural and humoral factors.
151 Endocrine function of the kidneys.

10. INDEPENT STUDY

Mode of study: full-time. Estimated student work time in academic hours -36

Independent work is made up of preparing for classes on questions for each lesson and preparation for intermediate control on questions for offset and examination. The following educational technologies are used in the organization of independent work of classes: Auditorium independent work on the discipline is performed on practical exercises under the direct guidance of the teacher and on his instructions. The workshop on normal physiology contains various experimental tasks in accordance with all the main sections of the theoretical course and is independently carried out in the laboratory of the Department of Physiology, equipped with laboratory equipment. As part of the course, students solve virtual problems - this is a simulator for independent work. Outside classroom independent work is performed by the student on the instructions of the teacher, but without his direct participation. The main types of independent work of students without the participation of teachers are: the formation and assimilation of the content of lecture notes on the basis of textbooks recommended by the lecturer, including information educational resources (electronic textbooks, electronic libraries,

etc.); preparation for practical work, their design.

Name of the section / subject	Types of educational activities	Academic hours	Assessment methods
Section 1 Principles of functioning of organs and systems			
Topic 1. Introduction. General physiology and biophysics of excitable tissues. Periods of development of the human body. Age peculiarities of the formation and regulation of physiological functions 1. Cell. Its functions. 2. Body tissues (epithelial, connective, muscular and nervous), the main features of their functions. 3. Features of low-excitable connective tissue (connective, bone, cartilage).	Elaboration of educational material, preparation for the delivery of the colloquium, test and examination.	4	Interview, tests, problem solving check.
Topic 2. Bioelectric phenomena in living systems. 1. Biopotentials of glandulocytes. The secretory cycle. Topic 2. Physiology of nerve fibers and the nerves conductors. Physiology of muscles. Features of the physiology of nerves and synapses. 1. Electroneurography. 2. Physiology of nerve fibers and nerves. 3. The parabiosis (N.E. Vvedensky). 4. Electromyography.	Elaboration of educational material, preparation for the delivery of the colloquium, test and examination.	4	Interview, tests, problem solving check.
Topic 3. General physiology of the CNS. Structure and properties of synapses. 1. The blood-brain barrier. 2. The glia, its function. Methods of research of functions of the central nervous system. 3. The physiological meaning of the doctrine of regulation functions for general medicine and clinical disciplines, to form concepts about health and healthy lifestyle.	Elaboration of educational material, preparation for the delivery of the colloquium, test and examination.	4	Interview, tests, problem solving check.
Topic 4. Inhibition of the nerve centers. Coordination of the reflex activity. 1. Features of processes of excitation and inhibition	Elaboration of educational material, preparation for	4	Interview, tests, problem solving check.

2. The iconic function of the brain: gnosis, praxis.	the delivery of the colloquium, test and examination.		
Topic 5. Physiology of the spinal cord, brainstem and cerebellum. 1. The brain stem.	Elaboration of educational material, preparation for the delivery of the colloquium, test and examination.	4	Interview, tests, problem solving check.
Topic 6. Physiology of the reticular formation 1. Features of neural organization.	Elaboration of educational material, preparation for the delivery of the colloquium, test and examination.	4	Interview, tests, problem solving check.
Topic 7. Physiology of the diencephalon, limbic system and basal nuclei. Physiology of the autonomic nervous system. Features of physiology of the Central nervous system of the developing organism. Features of the autonomic nervous system in children 1. Physiology of limbic system and basal nuclei. 2. The thalamus is a collector of afferent pathways.	Elaboration of educational material, preparation for the delivery of the colloquium, test and examination.	4	Interview, tests, problem solving check.
Topic 8. Methods of evaluating cardiac activity. 1. Ballisto-, echo-, vectorgraphy	Elaboration of educational material, preparation for the delivery of the colloquium, test and examination.	2	Interview, tests, problem solving check.
Topic 9. The regulation of heart activity. Integration of mechanisms regulating the functioning of the heart.	Elaboration of educational material,	2	Interview, tests, problem solving check.

	preparation for the delivery of the colloquium, test and examination.		
Topic 10. The basic laws of hemodynamics 1. Regional circulation. 2. Methodology of the study of organ blood flow (occlusive, plethysmography, ultrasound, and electromagnetic flowmetry). 3. Methods of research of microcirculation. 4. Functional features of the pulmonary circulation, coronary blood flow. 5. Factors of a healthy lifestyle that prevent the disturbance of the blood circulation system. 6. Age features of the circulatory system. 7. Change of organ blood flow during muscular exercise, food intake, pregnancy, hypoxia, stress and other conditions.	Elaboration of educational material, preparation for the delivery of the colloquium, test and examination.	2	Interview, tests, problem solving check.
Topic 11. The lymphatic system, its structure and functions. Features of blood circulation. Chylopoesis and mechanisms of its regulation. The factors supplying the flow of lymph and the mechanisms of its regulation.	Elaboration of educational material, preparation for the delivery of the colloquium, test and examination.	2	Interview, tests, problem solving check.
Topic 12. Physiology of breathing. External respiration. The mechanism of inhalation and exhalation. Transport of gases by blood. Transport of gases by blood.	Elaboration of educational material, preparation for the delivery of the colloquium, test and examination.	2	Interview, tests, problem solving check.
Topic 13. Digestion in the intestine. The importance of microorganisms and gas in the intestines.	Elaboration of educational material, preparation for the delivery of the colloquium,	3	Interview, tests, problem solving check.

	test and examination.		
Topic 14.1. Thermoregulation. 1. Peculiarities of thermoregulation in children. 2. Temperature-regulation. 3. System mechanisms of thermoregulation and heat transfer. 4. Mechanisms of hardening of the body.	Elaboration of educational material, preparation for the delivery of the colloquium, test and examination.	2	Interview, tests, problem solving check.
Topic 14.2. Metabolism	Elaboration of educational material, preparation for the delivery of the colloquium, test and examination.	2	Interview, tests, problem solving check.
Topic 15. Physiology of the excretion. 1. Adaptive changes of renal function in different environmental conditions. 2. Skin as an excretory organ. The function of sebaceous and sweat glands, regulation of their activities. Non-excretory function of the skin.	Elaboration of educational material, preparation for the delivery of the colloquium, test and examination.	1	Interview, tests, problem solving check.
Topic 16. Physiology of the endocrine glands. 1. Epiphysis. Thymus.	Elaboration of educational material, preparation for the delivery of the colloquium, test and examination.	1	Interview, tests, problem solving check.
Topic 17. Blood physiology. 1. Lymph, its composition, quantity, functions, physiological significance. 2. Extravascular fluid of the body (interstitial, cerebrospinal, synovial, pleural, peritoneal, liquid medium of the eyeball, slime) and their role in supplying the vital activity of body cells. 3. The factors that maintain the integrity of	Elaboration of educational material, preparation for the delivery of the colloquium, test and examination.	2	Interview, tests, problem solving check.

the body. Barriers external and internal environment of the body. Immunity and its types.			
Topic 17.1. The organism and its protective systems. 1. Protective reflexes.	Elaboration of educational material, preparation for the delivery of the colloquium, test and examination.	1	Interview, tests, problem solving check.
Topic 18. Physiology of analyzers. 1. Acupressure points and the principle of reflexology.	Elaboration of educational material, preparation for the delivery of the colloquium, test and examination.	4	Interview, tests, problem solving check.
Section 2. Functional systems of human organism, their regulation and self-regulation when exposed to the external environment			
Topic 19. The doctrine about functional systems. 1. System organization of functions.	Elaboration of educational material, preparation for the delivery of the colloquium, test and examination.	2	Interview, tests
Topic 20. Functional system providing optimal level of metabolism of gases.	Elaboration of educational material, preparation for the delivery of the colloquium, test and examination.	2	Interview, tests, problem solving check.
Topic 21. Functional digestive system and place it in the digestive process.	Elaboration of educational material, preparation for the delivery of the colloquium,	2	Interview, tests

	test and examination.		
Topic 22.1. The organism's adaptation to different conditions of existence. 1. Biorythmology (chronobiology). The idea of the discreteness of various processes in the body. Cyclical processes. 2. Physiology of adaptation. Individual adaptation. Types, phases, and criteria of adaptation. Theme 22.2. Purposeful behavior. 1. Purposeful behavior as a form of behavior leading to achieving the body adaptive result. 2. Physiological basis of labour activity. Theme 22.3.The problem of fatigue of the entire organism. 1. Leisure (I. M. Sechenov) and its mechanisms. 2. Features of physical and mental work. 3. The optimum conditions for work and rest as the basis for a long period of high efficiency of the organism.	Elaboration of educational material, preparation for the delivery of the colloquium, test and examination.	3	Interview, tests
Topic 23. The phenomenon of inhibition of HNA. 1. Types and mechanisms of inhibition of HNA. 2. The physiology of sleep. 3. The physiological basis of hypnotic conditions.	Elaboration of educational material, preparation for the delivery of the colloquium, test and examination.	3	Interview
Topic 24. The types of HNA. The doctrine of 1 and 2 signal systems. Memory. Thinking. Consciousness. Language.	Elaboration of educational material, preparation for the delivery of the colloquium, test and examination.	3	Interview

Topic 25. Reproduction. 1. Reproduction stages. 2. Anatomical and physiological basis of reproduction. 3. The formation and mechanisms of sexual motivation. 4. Phase of the sexual cycle in men. Specificity of phases of the sexual cycle in women.	Elaboration of educational material, preparation for the delivery of the colloquium, test and examination.	1	Interview
Topic 26. Physiology of pain and pain relief. 1. Pain as a sensation and condition. 2. Nociception. Antinociception. 3. Physiological mechanisms of pain and analgesia.	Elaboration of educational material, preparation for the delivery of the colloquium, test and examination.	1	Interview
Topic 27. Practical skills	Elaboration of educational material, preparation for the delivery of the colloquium, test and examination.	1	Interview
Form of knowledge control on the independent study of the subject: a colloquium, credit and exam.			

Practical skills
For self-study the students are recommended basic and additional educational literature and educational and methodical manuals, published at UlSU. Workshop on normal physiology contains various experimental tasks in accordance with all the main sections of the theoretical course and independently performed in the laboratory of the Department of physiology, with laboratory equipment. In this course students solve virtual problem - it is the simulator for independent work.

Form of control of knowledge by self-guided study of the subject: **the colloquium, a credit and an examination**.

11.Bibliography

Recommended Core Bibliography

1.Dorokhov, Ye. V. Normal physiology / Dorokhov Ye. V., Karpova A. V., Semiletova V. A. [et al.] - Москва: ГЭОТАР-Медиа, 2021. - 512 с. - ISBN 978-5-9704-6136-5. - Текст: электронный // ЭБС "Консультант студента": [сайт]. - URL: https://www.studentlibrary.ru/book/ISBN9785970461365.html

2. Лапкин, М. М. Избранные лекции по нормальной физиологии = Selected Lectures on Normal Physiology: учебное пособие на русском и английском языках / М. М. Лапкин, Е. А. Трутнева. - Москва: ГЭОТАР-Медиа, 2021. - 544 с. - 544 с. - ISBN 978-5-9704-5972-0. - Текст: электронный // ЭБС "Консультант студента": [сайт]. - URL: https://www.studentlibrary.ru/book/ISBN9785970459720.html

Recommended Additional Bibliography

1.Normal physiology : education guidance for students of medical faculty. Part 1. Physiology of excitable tissues, muscles, CNS, analyzers, HNA / T. P. Gening, T. V. Abakumova, N. L. Mikhailova, E. N. Kadysheva ; Ulyanovsk State University, Insitute of Medicine, Ecology and Physical culture. - 2nd ed. - Электрон. текстовые дан. (1 файл : 4,99 Мб). - Ulyanovsk : ULSU, 2018. - Текст на англ. яз. - Загл. с экрана. - Текст : электронный. http://lib.ulsu.ru/MegaPro/Download/MObject/1201

2. Normal physiology : education guidance for students of medical faculty. Part 2. Physiology of Cardio-vascular system, Breath, Digestion, Excretion, Endocrine glands, Metabolism and Energy, Blood / T. P. Gening, T. V. Abakumova, N. L. Mikhailova, E. N. Kadysheva ; Ulyanovsk State University, Insitute of Medicine, Ecology and Physical culture. - 2nd ed. - Электрон. текстовые дан. (1 файл : 5,55 Мб). - Ulyanovsk : ULSU, 2018. - Текст на англ. яз. - Загл. с экрана. - Текст : электронный. http://lib.ulsu.ru/MegaPro/Download/MObject/1202

3. Нормальная физиология = Normal physiology : учебник / В. В. Зинчук, О. А. Балбатун, С. Д. Орехов [и др.] ; под редакцией В. В. Зинчука. — Минск : Вышэйшая школа, 2020. — 496 с. — ISBN 978-985-06-3245-6. — Текст : электронный // Цифровой образовательный ресурс IPR SMART : [сайт]. — URL: https://www.iprbookshop.ru/120003.html

4. Physiology of excitable tissues : education guidance for students of medical faculty / T. P. **Gening**, T. V. Abakumova, S. O. **Gening**, D. A. Kseiko ; Ulyanovsk State University, Faculty of Medicine. - Ulyanovsk : UlSU, 2022. - 82 p. - На англ. яз. - Загл. с экрана. - URL: http://lib.ulsu.ru/MegaPro/Download/MObject/14451. - Режим доступа: ЭБС УлГУ. - Текст : электронный.

Supplementary teaching material designed by the academic staff implementing the National Curriculum of Higher Professional Education

Gening T. P. Workshop on normal physiology : methodological guidance for students of medical faculty / T. P. Gening, T. V. Abakumova, S. O. Gening. - Ulyanovsk : UlSU, 2022. - 35 p. - На англ. яз.; Неопубликованный ресурс. - URL: http://lib.ulsu.ru/MegaPro/Download/MObject/11499. - Режим доступа: ЭБС УлГУ. - Текст : электронный.

Approved by:

Leading specialist /Stadolnikova D.R./_____/ 14.05.2024

Specialist of institutional Research library — name — signature — date

b) Educational software:

1. Электронно-библиотечные системы:

1.1. Цифровой образовательный ресурс IPRsmart : электронно-библиотечная система : сайт / ООО Компания «Ай Пи Ар Медиа». - Саратов, [2024]. – URL: http://www.iprbookshop.ru. – Режим доступа: для зарегистрир. пользователей. - Текст : электронный.

1.2. Образовательная платформа ЮРАЙТ : образовательный ресурс, электронная библиотека : сайт / ООО Электронное издательство «ЮРАЙТ». – Москва, [2024]. - URL: https://urait.ru . – Режим доступа: для зарегистрир. пользователей. - Текст : электронный.

1.3. База данных «Электронная библиотека технического ВУЗа (ЭБС «Консультант студента») : электронно-библиотечная система : сайт / ООО «Политехресурс». – Москва, [2024]. – URL: https://www.studentlibrary.ru/cgi-bin/mb4x. – Режим доступа: для зарегистрир. пользователей. – Текст : электронный.

1.4. Консультант врача. Электронная медицинская библиотека : база данных : сайт / ООО «Высшая школа организации и управления здравоохранением-Комплексный медицинский консалтинг». – Москва, [2024]. – URL: https://www.rosmedlib.ru. – Режим доступа: для зарегистрир. пользователей. – Текст : электронный.

1.5. Большая медицинская библиотека : электронно-библиотечная система : сайт / ООО «Букап». – Томск, [2024]. – URL: https://www.books-up.ru/ru/library/ . – Режим доступа: для зарегистрир. пользователей. – Текст : электронный.

1.6. ЭБС Лань : электронно-библиотечная система : сайт / ООО ЭБС «Лань». – Санкт-Петербург, [2024]. – URL: https://e.lanbook.com. – Режим доступа: для зарегистрир. пользователей. – Текст : электронный.

1.7. ЭБС Znanium.com : электронно-библиотечная система : сайт / ООО «Знаниум». - Москва, [2024]. - URL: http://znanium.com . – Режим доступа : для зарегистрир. пользователей. - Текст : электронный.

2. КонсультантПлюс [Электронный ресурс]: справочная правовая система. / ООО «Консультант Плюс» - Электрон. дан. - Москва : КонсультантПлюс, [2024].

3. eLIBRARY.RU: научная электронная библиотека : сайт / ООО «Научная Электронная Библиотека». – Москва, [2024]. – URL: http://elibrary.ru. – Режим доступа : для авториз. пользователей. – Текст : электронный

4. Федеральная государственная информационная система «Национальная электронная библиотека» : электронная библиотека : сайт / ФГБУ РГБ. – Москва, [2024]. – URL: https://нэб.рф. – Режим доступа : для пользователей научной библиотеки. – Текст : электронный.

5. Российское образование : федеральный портал / учредитель ФГАУ «ФИЦТО». – URL: http://www.edu.ru. – Текст : электронный.

6. Электронная библиотечная система УлГУ : модуль «Электронная библиотека» АБИС Мега-ПРО / ООО «Дата Экспресс». – URL: http://lib.ulsu.ru/MegaPro/Web. – Режим доступа : для пользователей научной библиотеки. – Текст : электронный.

Инженер ведущий Щуренко Ю.В. 2024

12. EDUCATIONAL FACILITIES

Room № 310 is used for conducting lectures The room is furnished with a set of student furniture seating 400 people. The 23 square meter room is equipped with a TV set, a video tape recorder , a direct internet access, and a whiteboard.	310, Building 4, 1, Universitetskaya Naberezhnaya Street, Ulyanovsk, the Ulyanovsk Region
Room № 204 is used for conducting practical sessions, class sessions and tutorials, for formative and summative assessment (and equipped to demonstrate visual aids designed to implement the syllabus. The room is furnished with a set of student furniture seating 36 people. The 55 square meter room is equipped with a TV set, electrophysiological research equipment in humans Biopac Student Lab, computer, a direct internet access, and a whiteboard	204, 2/1 Arch.Livchak Street, Ulyanovsk, the Ulyanovsk Region
Room № 205 is used for conducting practical sessions, class sessions and tutorials, for formative and summative assessment (and equipped to demonstrate visual aids designed to implement the syllabus. The room is furnished with a set of student furniture seating 26 people. The 42 square meter room is equipped computer for conducting a virtual workshop, a direct internet access, and a whiteboard	204, 2/1 Arch.Livchak Street, Ulyanovsk, the Ulyanovsk Region
Room № 203 is used for conducting practical sessions, class sessions and tutorials, for formative and summative assessment (and equipped to demonstrate visual aids designed to implement the syllabus. The room is furnished with a set of student furniture seating 26 people. The 41.5 square meter room is equipped with a TV set, electrophysiological research equipment in humans Biopac Student Lab, computer, a direct internet access, and a whiteboard	204, 2/1 Arch.Livchak Street, Ulyanovsk, the Ulyanovsk Region
The institutional research library service department (Room 31 B) has an area for independent studies, Wi-Fi and a direct access to virtual learning environment and e-libraries. The 31,8 square meter room is furnished with a special set of furniture seating 10 students,	106, Building 2, Naberezhnaya Reki Sviayagi Street, Ulyanovsk, the Ulyanovsk Region
The institutional research library reading room (Room 237) has an area for independent studies, Wi-Fi and a direct access to virtual learning environment and e-libraries The 220 square meter room is furnished with a special set of furniture seating 80 students and equipped with computers and an overhead projector	106, Building 2, Naberezhnaya Reki Sviayagi Street, Ulyanovsk, the Ulyanovsk Region

LIST OF EQUIPMENT FOR EDUCATIONAL PROCESS

№	Name	Count	Planned to be
1	Electrocardiograph EK – 1	1	1
2	Electrocardiograph one/three-channel EC1T-1/3-07 "Axion"	1	1
3	Electrocardiograph one/three-channel "Axion"	1	1
4	Distiller DE-4-2M	1	1
5	Audiometer	1	1

6	Sterilizer GP-20	1	1
7	Fridge	2	2
8	Centrifuge OPN-8	1	1
9	The stereotactic radiotherapy SEG-5	1	1
10	Centrifuge hematocrit. TT-2	-	2
11	Microscope Lumam	1	1
12	The stereoscopic microscope Leica EZ40	1	2
13	The microscope MICMED	2	2
14	Electrostimulator SP-01-AP	3	3
15	Recorder type H-3031 – 1 channel	2	2
16	A set of pipette	8	8
17	Neurological hammer	3	4
18	Spring clips – serpinas	10	10
19	The Engelmann’s levers	4	4
20	Scales VK 150,1 (from 0.005 to 150 g)	1	1
21	Libra pharmacy	4	4
22	The weights from 1 mg to 500 g	1	4
23	Mechanic tonometer LD-71	6	6
24	Water thermometer	2	2
25	Phonendoscope	10	10
26	The forked electrodes	4	4
27	Polygraph for electrophysiological studies MF30 (Biopac Student Lab), expanded.	1	1
28	Hardware-software program complex "Valenta" for research	1	1
29	"Neyrovizor" system for registration and analysis of EEG, evoked potentials and physiological parameters	1	1
30	TV Daewoo 20Q3M	1	1
31	Videoplayer	1	1
32	DVD-player United 7062	4	4

LIST OF VIDEOS ON NORMAL PHYSIOLOGY

The autonomic nervous system - 1 part.
Higher nervous activity. Types of GNI. - 4 parts.
Analyzers (auditory, gustatory). - 2 parts.
Compensatory and adaptive function. - 2 parts.
Renal excretory function - 1 part.
Bladder dysfunction. - 2 parts.
Blood cells. - 2 parts.
Thermoregulation - 1 part.
Adaptation of the organism. - 2 parts.
Transfer of blood gases. - 1 part.
Hormones - 1 part.

13. OPTIONS FOR STUDENTS WITH DISABILITIES

If necessary, students from among persons with disabilities (at the request of the student) may be offered one of the following options for perceiving information, taking into account their individual psychophysical characteristics:

- for persons with visual impairment: in print in large print; in the form of an electronic document; in the form of an audio file (translation of training materials into audio format); in printed form in Braille; individual consultations with the involvement of a tiflos sign language interpreter; individual tasks and consultations;
- for persons with hearing impairment: in printed form; in the form of an electronic document; video materials with subtitles; individual consultations involving an interpreter; individual tasks and consultations;
- for persons with disorders of the musculoskeletal system: in print; in the form of an electronic document; in the form of an audio file; individual tasks and consultations.

If it is necessary to use partially / exclusively distance educational technologies in the educational process, the organization of work of the teaching staff with students with disabilities and disabled people is provided in the electronic information and educational environment, taking into account their individual psychophysical characteristics.

Course designer _____ Head of Department _____ Tatyana P.Gening
signature job title name

Course designer _____ Professor _____ Tatyana V.Abakumova
signature job title name