1. The work program of the academic discipline

1.1. Explanatory note

The mission of ISM IUK is to train competent specialists in the field of medicine that meet international standards and traditions of medical ethics, ready for continuous professional growth using modern achievements of science and practice, to solve public health problems.

Annotation of the academic discipline

Physiology is the science of the mechanisms of functioning and regulation of the activity of cells, tissues, organs, systems and the organism as a whole and its interaction with the environment. Physiology is the theoretical basis of medicine, about which the great Russian physiologist Ivan Petrovich Pavlov spoke, since a deep knowledge of the laws of physiology ensures the successful development of clinical disciplines. Physiology is a theoretical basis for the study of traditional and non-traditional methods of treatment, methods of functional diagnostics.

The purpose and objectives of the discipline

The purpose of the discipline

- to form the fundamental and systemic basis of the physiological mechanisms of the human body's vital activity at different levels of organization; instill practical skills in fundamental and applied research in medicine.

Discipline objectives:

- study by students of research methods for assessing the state of the regulatory and homeostatic systems of the body in the experiment, used for diagnostic purposes in practical medicine;
- the formation of students' ideas about the structure and patterns of functioning of individual organs and systems of the body, as well as about the work of the

main regulatory mechanisms of physiological functions in the formation of integral responses;

- formation of students' systematic approach to understanding the physiological mechanisms underlying the interaction with environmental factors and the implementation of adaptive strategies of the human body from the standpoint of the concept of functional systems.

Place of discipline in the structure of OOP (prerequisites, postrequisites)

The academic discipline "Normal Physiology" is studied by students in the specialty 560001 General Medicine (for foreign citizens) and is included in the mandatory scope of the disciplines studied in the professional cycle of the State Educational Institution of Higher Professional Education.

Prerequisites. Successful mastering of the discipline "Normal physiology" is based on the content of such previous disciplines as:

- Mathematics (higher algebra, mathematical analysis, mathematical statistics);
- Physics (electromagnetic radiation, Coulomb interaction, diffraction);
- Inorganic chemistry (structure and properties of atoms, periodic law, molecular structure, theory of chemical bonding);
- Physical chemistry (nature of chemical bonds in molecules and crystals, chemical thermodynamics, phase diagrams);
- Organic chemistry (classification and nomenclature of compounds, molecular structure, isomerism);
- Biochemistry (biochemistry of organs and tissues, biochemical basis of the processes occurring in the human body);
- Biology (structure and function of proteins and nucleic acids, genes and genomes, self-organization of living systems, fundamentals of biotechnology, environmental factors);
- Anatomy and histology of the human body.

Post-requisites. Subsequently, the knowledge gained in the course of studying the discipline "Normal Physiology" will be necessary in the study of other theoretical and clinical disciplines, pathological physiology, clinical physiology, microbiology, immunology, neurology, internal diseases, endocrinology, pharmacology, etc. Knowledge about the normal functioning of the human body underlies the diagnosis and correction of diseases studied in clinical disciplines, preclinical interpretation and analysis of the functioning of the human body.

Competencies of students, formed as a result of mastering the discipline, the planned results of mastering the academic discipline.

A graduate in the specialty 560001 "General Medicine" with the qualification of a specialist (doctor) in accordance with the State Educational Standard of Higher Professional Education and OED and the tasks of professional activity, must have the following professional competencies: PK15, APK6.

PK-15 - is able and ready to analyze the patterns of functioning of individual organs and systems, use knowledge of anatomical and physiological characteristics, the main methods of clinical and laboratory examination and assessment of the functional state of the body of an adult and children, for the timely diagnosis of diseases and pathological processes;

APK-6 - is able to introduce scientific approaches into the practice of teaching based on the results of scientific research in related medical fields.

The planned results of mastering the academic discipline "Normal physiology" are determined by the competencies acquired by the student, i.e. his ability to apply knowledge, skills and personal qualities in accordance with the goals of the educational program and the tasks of professional activity.

LR1 - the ability to analyze socially significant problems, solve professional problems using basic natural science, mathematical and humanitarian concepts and methods in various activities.

LR6 - the ability to learn throughout life and apply basic knowledge in the field of fundamental disciplines in professional activities for the timely diagnosis and choice of treatment tactics.

LR12 - possess the skills of solving strategic tasks for conducting research and innovative professional activities based on the principles of evidence-based medicine for the development and implementation of new methods and technologies in the field of healthcare.

After mastering the discipline "Normal physiology" the student must:

Know

- physicochemical essence and physiological properties of tissues, organs and systems of the human body, the patterns of their functioning, the comparative aspect of the formation of functions;
- physiological processes and mechanisms of their regulation at the molecular, cellular, tissue, organ and organism levels, considered from the standpoint of general physiology, particular physiology and integrative, behavioral activity of a person;
- about the theory of functional systems (P.K. Anokhin), the mechanisms and features of the formation of functional systems of the body (maintaining the constancy of the internal environment, the level of nutrients in the blood, blood pressure, temperature of the internal environment, maintaining the integrity of the body, etc.) when interacting with the external environment;
- basic principles of physiological equipment and safety rules when working with it.
- the concept and methods of functional diagnostics, the essence of research methods for various functions of a healthy body used in medicine;

Be able to

1. Use knowledge

- about the properties and functions of various systems of the body when analyzing the regularities of the formation of functional systems of the body of a healthy person, depending on the conditions of its existence;
- use educational, scientific, popular science literature, the Internet to obtain up-to-date information on normal physiology for professional activity.

2. Analyze

- patterns of activity of various body systems at different functional states;
- dynamics of physiological processes under different types of stress;
- and interpret the results of modern methods of functional and laboratory diagnostic methods to identify pathological processes in human organs and systems.
- explain the information value of various indicators (constants) and mechanisms of regulation of organs, systems and activities of the whole organism.

3. Conduct research:

- with living objects in laboratory and natural conditions;
- using physical, chemical, biochemical and electrophysiological equipment.

Own

- knowledge and skills in the protection of health and safety of human life.
- skills of organizing their activities, initiative, mobility, skills of maintaining personal safety, interaction and cooperation with others;
- the skills of measuring and giving a qualitative and quantitative assessment of the most important physiological indicators of the activity of various organs and systems at rest and during exercise, as well as highlighting the main mechanisms of regulation of homeostatic functions.
- skills of carrying out elementary statistical processing of experimental data.

1.2. Recommended educational technologies

For the development of students of the academic discipline "Normal Physiology", the acquisition of knowledge and the formation of professional competencies, the following educational technologies are used:

- lecture-presentation,
- video lectures and videos,
- method of problem statement (case study, role-playing games, ranking),
- team-oriented training (work in small groups, "brainstorming", carousel),
- discussions, debates
- participation in scientific and practical conferences, forums and olympiads,
- research method (projects, reproductive method),
- written analytical work (preparation and defense of abstracts, reports, graphic organizers)
- binary lectures, lectures with errors
- IT applications (google classroom, kahoot, wizer.me, quiz, Meet, Zoom).

1.3. The scope of the discipline and types of educational work

According to the 2021 curriculum	**1st semester**	**2ns semester**	**Total**	
			Hours	**Credits**
Total labor intensity	**4**	**4**	**240**	**8**
Classroom	72	72	144	
Lectures	36	36	72	
Practice lessons	19	18	37	
Seminars				
Laboratory works	17	18	35	
Students' work				
Abstracts	24	24	48	
Reports	24	24	48	
Final control type	Exam	Exam		

1.4. Structure of the discipline

1.4.1. Thematic plan for the study of the discipline

The content of the 1st semester

№	Name of sections and topics of the discipline (lectures and workshops)	Classroom lessons				Total hours for classroom work	Reports	Students' work	Formed competencies	Educational technologies used, teaching methods and methods	Forms of current and midterm control academic performance
		Lectures	Seminars	Practice lessons	Laboratory work						
	Physiology of blood										
1.	Introduction to Physiology. Homeostasis. Physicochemical constants of blood.	2		1	1	4	1	1	APK-6, PK-15	*PL, VL, YN, S, RM*	*I*
2.	Corpuscular elements of blood. Red blood cells. Hemoglobin.	2			1	3	1	1		*PL, LE, RM, S, E, D*	*I, S*
3.	Leukocytes. Immunity.	2			2	4	1	1		*PL, WP, C, E, D*	*I,*
4.	Blood types	2			1	3	1	1		*PL, RM, S*	
5.	Hemostasis. Anticoagulant system	2			2	4	1	1		*PL, RM, S*	*S*
	Module 1		2			2				*CS*	*IWS, I, T, CTP*
	Physiology of excitable tissues										
6.	Plasma membrane. Resting membrane and action potential	2			2	4	1	1	APK-6, PK-15	*PL, LE, RM*	*I, C, R*
7.	Nerve fibers, conduction of impulses	2		1	1	4	1	1		*ML, D, E, RM*	*I*
8.	Physiology of synapses. Neurotransmitters	2		1		3	1	1		*PL, E, C*	*I, R*
9.	Physiology of movement	2		1	1	4	1	1		*PL, VL, SGW, CTP, RM*	*I, ГО*

10.	Endocrine glands	2		2		4	1	1		*PL, VL, CTP, D, E*	*I*
	Module 2			1		1				*CS*	*T, IWS*
	Physiology of the Nervous system										
11.	General principles of coordination in the central nervous system. Reflex and reflex arc	2			2	4	1	1	APK-6, PK-15	*PL, PL, RM*	*I*
12.	Physiology of the central nervous system. Brain stem and spinal cord.	2		1	1	4	1	1		*PL, LE, VL, RM, E*	*I*
13.	Reticular activating system.	2		1	1	4	1	1		*PL, LE, VL, RM, E*	*I*
14.	The cerebral cortex. EEG	2		2		4	1	1		*PL, VL, VL, RM, E, BS, D, SGW*	*I*
15.	Physiology of the autonomic and somatic nervous systems.	2		2		4	1	1		*PL, VL, RM, A*	*I*
	Sense										
16.	General and special senses. Pain.	2		1		3	1	1	APK-6, PK-15	*PL, S, E, D*	*I*
17.	Vision and hearing	2		1	1	4	1	1		*PL, VL, AW, R, D, SGW*	*I*
18.	Balance. Gustation and smell.	2		1	1	4	1	1		*PL,SGW, D, CTP, R*	*S, CTP*
	Module 3			1		1				*CS*	*T, R, IWS*
	Total for 1st semester	**36**		**19**	**17**	**72**	**18**	**18**			

The content of the 2nd semester

		Classroom lessons	Tot	Re	Stud	For	Educ	For

№	Name of sections and topics of the discipline (lectures and workshops)	Lectures	Seminars	Practice lessons	Laboratory work						
	Physiology of cardiovascular system										
1.	Cardiac muscle properties. ECG, interpretation	2		2		4	1	1	APK-6, PK-15	*LP, LE, E, D, RM*	*I*
2.	Cardiac cycle. Heart sounds. Regulation of the cardiac activity	2			2	4	1	1		*LP, RM, BS, SGW*	*S*
3.	Hemodynamics and functional role of blood vessels. The Lymphatic system	2			1	3	1	1		*LP, BL, SGW, D*	*S*
4.	Regulation of blood flow and blood pressure	2			1	3	1	1		*LP, AW, UCU*	*I, S*
	Module 1			1		1				*CS*	*T, AW*
	Physiology of Respiration and Digestion										
5.	Pulmonary ventilation. Spirometry	2			2	4	1	1		*LP, LE, SGW, D*	*S*
6.	Physical principles of exchange of gases. Transport of gases	2		1	1	4	1	1		*LP, SGW, CTP*	*E, I*
7.	Control of respiration. Hypoxia	2		1		3	2	2		*ML, VL, SGW, Y-N*	*E, I*
8.	Basic principles of Digestion. Digestion in the mouth and stomach	2		2		4	2	2		*LP, SGW, Y-N, CTP*	*S*
9.	Digestion and absorption in the small and large intestine. Liver and Pancreas. Bile	2		2		4	2	2		*ML, VL, CTP, C*	*S, E*
10.	Metabolism and energy balance	2			2	4	2	2		*LP, D, AW, SGW*	*I*

	Module 2			*1*		*1*				*CS*	*T, IWS*
	Thermoregulation. Excretion and Acid-base balance.										
11.	Principles of body temperature regulation	2		1		3	1	1		*PL, D, E, R*	*I*
12.	Physiology of excretion. GFR	2			2	4	1	1		*LP, LE, SGW, Y-N*	*S*
13.	Tubular reabsorption and secretion. Urine.	2		2		4	2	2		*ML, Y-N, VL, SGW*	*S*
14.	Acid-base balance	2		2		4	2	2		*LP, D, E, R*	*I*
	Module 3			*1*		*1*				*CS*	*T, IWS*
	High mental activity										
15.	Conditional and unconditional reflexes. Learning and memory.	2			1	4	1	1		*LP, LE, RM, SGW*	*E, S*
16.	Sleep and wakefulness. Dreaming.	2		2		4	1	1		*LP, SGW, C, CTP*	*I*
17.	Emotion, motivation and behavior	2			2	4	1	1		*LwM, ML, E, AW*	*S, CW*
18.	Perception, concentration and thinking. Adaptation	2			2	4	1	1		*LP, Y-N, CTP*	*S, E*
	Module 4			*1*		*1*				*CS*	*T, IWS*
	Total for 2nd semester	36		18	18	72	24	24			

Abbreviation of the designations of educational technologies, methods and methods of teaching: traditional lecture (L), multimedia lecture (ML), problem lecture (LP), lecture with errors (LE), lesson-conference (TC), brainstorming (BS), master class (MC), "round table" (RT), regulated discussion (RD), business and role-playing educational game (BG, RG), work in small groups (SGW), Yes-No method (Y-N), use of computer training programs (CTP), interactive atlases (IA), participation in scientific and practical conferences (SPK), congresses, symposia (Sim), reproductive method (RM), subject Olympiads (O), preparation of written analytical works (AW), preparation and defense of abstracts (E), project technology (PT), excursions (E), information technology (IT), survey (O), ranging (R), work in pairs (WP), modelling (M).

Reducing the forms of current and milestone monitoring of progress: T - testing, PS - assessment of the development of practical skills (abilities), CS - solving case studies, CW - control work, CT - control task, IWS - independent work, I - interview on control questions and etc.

1.4.2. Organization of students' independent work

1st semester

№	Theme of the students' work	Students' work task (essay, report, abstract, tables, presentation, note-taking, extracts, crosswords, solving situational problems,	Form of students' work	Deadlines (number of week)

		exercises, cases, preparing for business games, testing on the topic)		
1st semester				
1.	Functional systems	1. General principles of the functioning of the whole organism: 1.correlation 2.regulation 3.reflex 4.Self-regulation 2. Functional systems, interaction of elements	Crossword	1-2
2.	History of the development of physiology	1. Formation of physiology as a science 2. Development of physiological science during the Renaissance 3. Contribution of the Russian school of physiologists	Abstract	1-2
3.	Neurohumoral regulation of functions - as the basis of homeostasis	1. The internal environment of the body and the concept of homeostasis. 2. The role of humoral factors in maintaining homeostasis. 3. Distinctive features of humoral and nervous mechanisms of regulation. 4. Interaction of nervous and humoral mechanisms of regulation.	Presentation	2-3
4.	Homeostasis, mechanisms of its regulation	1. The concept of homeostasis. General laws of homeostasis of living systems. 2. Self-regulation and maintenance of homeostasis of the cellular level of the organization of living 3. Homeostasis of the molecular level of organization of living 4. Systemic mechanisms of homeostasis regulation: nervous, endocrine, immune	Видеопрезентация	2-3
5.	Osmosis. Osmotic and oncotic pressure	1. The role of blood proteins 2. Osmotic and oncotic pressure 3. Isotonic coefficient 4. Hypo-, hyper- and isotonic solutions	Abstract	3-4
6.	Erythrocyte sedimentation rate and its interpretation	1. The rate of erythrocyte sedimentation. 2. Modern methods of determination 3. Interpretation of ESR results	Situational Tasks	3-4
7.	Blood coagulation system	1. The role of the coagulation process in ensuring homeostasis of the liquid state of the blood. 2. A brief history of the development of the theory of blood coagulation.	Test	4-5

		3. The process of activation of the blood coagulation system. 4. Causes of blood clotting disorders. 5. Anticoagulant system and its importance in providing a liquid state.		
8.	Immunological mechanisms of protection of the internal environment of the body	1. Immunity and its significance. History of the study of immunity. 2. Cellular immunity and its mechanisms. 4. Humoral immunity and its mechanisms. 5. The nature of antigen and antibodies. 6. Interrelation of cellular and humoral immunity.	Presentation	4-5
9.	Natural antigens and human antibodies	1. The history of the discovery of human blood groups. 2. Types of natural antigens. AVO system. 3. Types of natural antibodies. 4. Geographic distribution of blood groups. 5. Blood transfusion. 6. Modern problems of blood transfusion.	Situational Tasks	5-6
10.	HIV infection. AIDS as a result of impaired immunity	1. The causative agent of HIV infection. 2. Influence of HIV on the immune system. 3. Mechanisms of HIV transmission. 4. HIV infection as a socio-economic problem.	Abstract	5-6
11.	Hematopoiesis.	1. Organs of hematopoiesis 2. Erythropoiesis 3. Formation of leukocytes and platelets. 4. Physiological regulation of hematopoiesis 5. Violations of hematopoiesis	Abstract	6-7
12.	Active and passive transport of various substances across membranes.	1. Permeability of the plasma membrane 2. Passive transport across cell membranes, examples 3. Active transport across cell membranes. Antiports and simports 4. Endocytosis and exocytosis	Drawing up a table	6-7
13.	Ion channels, ion pumps and their mechanism of action.	1. Ionic channels, their varieties 2. Sodium, calcium, potassium and chloride channels 3. Electrogenic and electrically neutral ion pumps	Abstract	7-8
14.	Electrical phenomena in excitable tissues. The history of their discovery.	1. History of the discovery of electrical phenomena in excitable tissues 2. Experiments by L. Galvani and K. Matteuchi 3. The role of biological membranes 4. Electrical properties of excitable tissues	Abstract	7-8
15.	Excitable tissues, changes in	1. Determination of excitement, excitability. 2. Change in the magnitude of the MF during depolarization and hyperpolarization.	Test	8-9

	excitability when exposed to direct electric current and when excited	3. Change in excitability with short-term and long-term exposure to direct current. 4. Accommodation and its mechanism. 5. Curve of changes in the excitability of a nerve fiber when the AP passes through it.		
16.	Resting membrane potential. Action potential. Interpreting the threshold stimulus	1. Biological significance of the membrane potential in living cells. 2. Ions participating in the maintenance of MF in living cells. 3. The biological significance of the action potential. 4. The sequence of events of the mechanism of occurrence of the action potential. 5. The role of the sodium-potassium pump in the mechanisms of formation of MP and PD, its energy supply.	Situational Tasks	8-9
17.	Muscle contraction and relaxation (modeling)	1. The mechanism of muscle contraction and relaxation 2. Huxley-Hanson theory 3. Energy supply of muscle contraction 4. Fatigue 5. The main mechanisms of neuro-humoral regulation of muscle activity	Моделирование	10-11
18.	Types of muscle contractions.	1. Types of muscle contractions: single, tone, tetanus 2. Contraction modes: isometric, isotonic, mixed 3. Laws of muscle contraction	Abstract	11-12
19.	Synapses, properties. TPSP and EPSP mechanisms.	1. The structure of the synapse of the central nervous system, different types of synapses. 2. The mechanism of transmission of excitation in the synapse. Formation of EPSP (excitatory postsynaptic potential). 3. Types of inhibition in the central nervous system. 4. Principle of interaction of EPSP and TPSP (inhibitory postsynaptic potential) on the neuron membrane.	Test	12-13
20.	Physiological properties of skeletal and smooth muscles	1. Structural organization of skeletal muscle 2. Molecular mechanisms of skeletal muscle contraction 3. Structural organization and contraction of smooth muscles Physiological properties of muscles	Drawing up a table	13-14

21.	Inhibition in the central nervous system, its types and role.	1. Electrophysiological expression of the inhibition process. 2. Inhibition in the spinal cord. 3. Contribution of I.M. Sechenov in the development of ideas about the mechanism of inhibition. 4. Inhibition in the cerebral cortex. 5. Principles of interaction of excitation and inhibition.	Video presentation	1 – 2
22.	Unconditional reflex activity of the brain	1. The essence of the reflex. 2. Distinctive features of unconditioned reflexes, their multilevel organization. 3. Instincts and their distinctive features. The parts of the brain involved in the implementation of instincts. 4. Biological significance of unconditioned reflex regulation of body functions. 5. Analysis of the reflex arc using the example of the knee reflex	Presentation	2-3
23.	Conditioned reflex activity of the brain	1. The essence of the reflex. 2. The fundamental difference between conditioned reflex activity and unconditioned reflex activity. 3. The mechanism of formation of a conditioned reflex. 4. The value of dominant, summation, irradiation in the closure of conditioned reflexes. 5. The principle of feedback. 6. The concept of a reflex ring.	Abstract	3-4
24.	The role of the cerebral cortex in the reflex activity of the brain	1. Neuron as an integrating element of the nervous system. 2. Features of the neuronal organization of the human cortex. 3. Structural and functional organization of the associative zones of the cortex, their role in the work of the cerebral hemispheres. 4. Locking function of the cerebral cortex, its importance in the adaptive activity of the organism. 5. Functional asymmetry of the cerebral hemispheres.	Test	4-5
25.	Autonomic nervous system	1. General principles of structure and basic physiological properties of the autonomic nervous system. 2. Vegetative innervation of tissues and organs.	Situational Tasks	5-6

		3. Sympathetic and parasympathetic divisions of the autonomic nervous system. 4. Vegetative reflexes and centers of regulation of vegetative functions.		
26.	Analyzers	1. I.P. Pavlov on analyzers. Analyzer as a complex system, its departments. 2. Receptors and their types. 3. Adaptation of receptors and its mechanism. 4. Coding information in the nervous system. 5. Possible functions of the primary and secondary sensory zones of the cerebral cortex.	Test	6-7
27.	Auditory analyzer	1. Auditory analyzer as a complex system. 2. Corti's organ. Electrical phenomena in the snail. 3. Perception of auditory stimuli (frequency, pitch and strength of sounds). 4. Cortical section of the auditory analyzer. 5. Adaptation of the auditory analyzer. 6. Determination of hearing acuity	Quizz	7-8
28.	Visual analyzer	1. Visual analyzer as a complex system. 2. The receptor system of the eye. 3. Photochemical and electrical phenomena in receptors. 4. Mechanism of accommodation and dark adaptation of the eye. 5. Color vision. 6. Coding information in the visual analyzer. 7. Determination of visual acuity	Cahoot	8-9
29.	Pain system	1. Pain receptors, their regulation 2. Sensory system of pain 3. Pain relief system		
30.	Intrasecretory function of the thyroid gland	1. Endocrine glands and their hormones. 2. The mechanism of action of hormones. 3. Intrasecretory function of the adenohypophysis. 4. Intrasecretory function of the neurohypophysis 5. Changes in the body with insufficient and excessive function of the pituitary gland.	Cahoot	9-10
31.	Intrasecretory function of the thyroid gland	1. Endocrine glands and their hormones. 2. The mechanism of action of hormones. 3. Intrasecretory function of the thyroid gland. 4. Changes in the body with insufficient and excessive thyroid function.	Situational Tasks	11-12
32.	The endocrine role of the pancreas and its role in metabolism.	1. Endocrine glands and their hormones. 2. The mechanism of action of hormones. 3. Intrasecretory function of the pancreas.	Situational Tasks	12-13

		4. Changes in the body with insufficient and excessive function of the pancreas.		
33.	Intrasecretory function of the thymus and pineal gland	1. Endocrine glands and their hormones. 2. The mechanism of action of hormones. 3. Intrasecretory function of the thymus. 4. Intrasecretory function of the pineal gland.	Abstract	13-14
34.	Intrasecretory function of the adrenal glands.	1. Endocrine glands and their hormones. 2. The mechanism of action of hormones. 3. Intrasecretory function of the adrenal cortex. 4. Intrasecretory function of the adrenal medulla. 5. Changes in the body with insufficient and excessive adrenal function.	Cahoot	14-15
35.	Intrasecretory function of the gonads	1. Endocrine glands and their hormones. 2. The mechanism of action of hormones. 3. Hormones of the ovaries, placenta and their function. 4. Hormones of the testes and their function. 5. Regulation of the intrasecretory activity of the gonads.	Quizz	15-16
36.	The hypothalamic-pituitary-adrenal system and its role in stress and adaptation.	1. GNS glands 2. The mechanism of action of hormones in stress 3. GNS as stress system and adaptive hormones 4. Physiological basis of stress	Abstract	16-17

2nd semester

№	**Theme of the students' work**	**Students' work task (essay, report, abstract, tables, presentation, note-taking, extracts, crosswords, solving situational problems, exercises, cases, preparing for business games, testing on the topic)**	**Form of students' work**	**Deadlines (number of week)**
1.	Anomalies in the development of the heart.	1. Formation of the heart 2. Small anomalies of heart development 3. Congenital malformations of the heart 4. Heart defects	Summary	1-2
2.	The influence of physical activity on the development and work of the heart.	1. Mechanisms of the influence of movements on the body 2. The effect of physical activity on the muscles of the cardiovascular system 3. Types of CVS responses to exercise 4. Muscle blood flow and cardiac output during sports	Solving ST	3-4

		5. Regulation of blood flow in skeletal muscles at rest and during exercise		
3.	The influence of mental activity and emotions on the cardiovascular system and pathology.	1. Influence of emotions on the heart 2. Methods for relieving emotional stress	Essay	3-4
4.	Comparative characteristics of the excitability of skeletal muscles and cardiac muscle.	1. Comparative characteristics of skeletal, smooth and cardiac muscles. 2. Features of excitability, conduction and contractility of skeletal muscle 3. Features of excitability, conduction and contractility of smooth muscle 4. Features of excitability, conduction and contractility of the heart muscle	Drawing up a table	1-2
1.	Cardiac activity	1. Functions of the heart. 2. Cardiac cycle. 3. The value of the conducting system of the heart. Automation of the heart. 4. Heart rate. Pacemaker. 5. Methods of research of heart activity. 6. Registration and analysis of electrocardiography	Solving ST	3-4
5.	Modern ideas about the mechanisms of cardiac muscle automatism.	1. Automation of the heart muscle: causes and features. 2. The degree of automation of various parts of the heart. 3. Experience of Stannius.	Summary	5-6
2.	Mechanisms of regulation of cardiac activity	1. Functions of the heart. 2. Cardiac cycle and its phases. 1. Efferent regulation of cardiac activity. 2. The role of various parts of the brain in the regulation of the heart. 3. Intercardial reflexes and their meaning. 4. Humoral mechanisms of regulation of heart activity. 5. Autoregular mechanisms. Self-regulation of heart contractions. O. Frank and E. Starling's law.	Cahoot!	5-6
6.	Modern methods for the study of cardiac activity.	1. ECG as one of the informative methods for studying the properties of the heart. 2. Auscultation of heart sounds 3. Phonocardiogram as a method for examining the heart.	Video presentation	5-6
3.	The movement of blood in the cardiovascular system	1. Hemodynamics - the doctrine of the movement of blood in the cardiovascular system. 2. Functional classification of vessels.	Video presentation	7-8

		3. The movement of blood through the arteries. 4. The movement of blood through the capillaries. 5. The movement of blood through the veins. 6. Regulation of vascular tone.		
4.	Blood pressure regulation mechanisms	1. The value of blood pressure. 2. Physiological mechanisms of nervous regulation of blood pressure. 3. Own and associated reflexes of the vascular system. 4. The humoral mechanism of blood pressure regulation. 5. Mechanisms of blood pressure regulation when changing body position, during muscular work. 6. Measurement of blood pressure	Test	7-8
7.	The role of the pleural cavity in the biomechanics of respiration.	1. Mechanisms of external respiration 2. Pressure in the pleural cavity, its origin 3. Changes in pleural pressure during breathing and the role of the mechanism of external respiration 4. Pneumothorax	Summary	7-8
8.	Lung surfactant and its importance for respiration.	1. Surfactant lung system, composition, role 2. Elastic traction of the lungs 3. The elastic resistance of the lungs	Summary	7-8
9.	Features of pulmonary ventilation at rest and during exercise.	1. Pulmonary volumes 2. Lung capacity 3. Anatomical and physiological dead space 4. Maximum and alveolar ventilation of the lungs 5. Obstructive and restructive lung diseases	Solving ST	8-9
5.	Gas exchange in the human body	1. The meaning of breathing. External and internal breathing. 2. Conditions conducive to gas exchange in the lungs. Potential reserves of pulmonary gas exchange. 3. The vital capacity of the lungs. 4. Gas composition of human blood and higher vertebrates. 5. The relationship between the intensity of external respiration and blood gas composition. 6. Determination of vital capacity of the lungs and its constituent volumes using a spirometer	Cahoot!	8-9

10.	Breathing in different conditions	1. Breathing at elevated atmospheric pressure 2. Specific conditions in submarines 3. Toxicity of oxygen at high pressure 4. Decompression sickness	Essay	8-9
11.	The effect of low oxygen pressure on the body.	1. Breathing at reduced atmospheric pressure 2. Artificial climate in a spaceship 3. Acute and chronic manifestations of hypoxia 4. Breathing during physical exertion	Essay	8-9
12.	Natural acclimatization of the indigenous people living at high altitudes.	1. Mechanisms of natural acclimatization to high mountain conditions (Tien Shan, Tibet and Himalayas) 2. Acute altitude sickness and high-altitude pulmonary edema 3. Chronic mountain sickness	Summary	7-8
13.	The effect of aging on the respiratory system.	1. Age-related anatomical and morphological changes in the respiratory system 2. The state of the small circle of blood circulation 3. Changes in the ventilation function of the lungs 4. Features of breathing regulation	Presentation	8-9
14.	Gas exchange regulation mechanisms	1. Concept of the respiratory center. The role of CO2 and O2 in the regulation of respiration. 2. Significance in respiration of impulses from the receptors of the lungs, respiratory muscles, airways and skeletal muscles. 3. Features of the process of self-regulation of respiration. 4. The role of the cerebral cortex in the regulation of respiration. 5. Regulation of breathing during muscular work, at low and high atmospheric pressure.	Test	8-9
15.	The mechanisms of absorption of substances in the gastrointestinal tract.	1. Absorption of nutrients in different parts of the gastrointestinal tract 2. Passive suction mechanisms 3. Active mechanisms of absorption 4. Suction regulation	Solving CS	9-10
16.	Digestion in the mouth	1. Salivary glands of the oral cavity. Saliva composition and its importance in digestion. 2. The effect of the sympathetic and parasympathetic systems on the nature of salivation.	Quiz game	9-10

		3. Center of salivation. The difference between the unconditional and conditioned reflex character of salivation. 4. Influence of humoral factors on salivation. 5. Reflex chewing and swallowing mechanism. 6. The breakdown of starch by saliva enzymes		
17.	Modern experimental methods for studying the activity of the digestive system.	1. Sharp experiences 2. Method of chronic experiment 3. Sounding 4. Radiography 5. Endoscopy 6. ultrasound 7. Scanning tomography 8. Electronic methods	Summary	9-10
18.	Digestion in the stomach	1. Glands of the stomach and features of their structure. 2. Composition and value of gastric juice. 3. Reflex mechanism of gastric secretion regulation. 4. Humoral regulation of gastric secretion. 5. Influence of gastric juice on milk proteins	Presentation	9-10
19.	Regulation of gastric secretion.	1. Phases of gastric secretion 2. Cerebral phase of gastric secretion 3. Gastric phase 4. Intestinal phase of gastric secretion 5. Method of obtaining gastric juice	Video presentation	9-10
20.	Intestinal digestion	1.Composition of pancreatic juice, intestinal juice and bile. 2. Digestion in the small intestine. 3. Digestion in the colon. 4. The process of suction, its mechanism. 5. Reflex and humoral mechanisms of regulation of the pancreas, small intestine glands, bile formation and bile secretion.	Solving ST	11-12
21.	Digestion in the small intestine	1. Внутриклеточное, внутриполостное и пристеночное пищеварение. 2. Особенности строения внутреннего слоя стенки кишечника и его значение. 3. Процесс всасывания и его механизмы. 4. Нервная регуляция деятельности желез тонкого кишечника. 5. Гуморальная регуляция секреции кишечных желез.	Test	11-12

22.	Physiological bases of hunger and satiety	1. Theories of the onset of hunger 2. Mechanisms of hunger development 3. Primary saturation 4. Secondary saturation 5. Centers of hunger and satiety		11-12
23.	The microflora of the large intestine.	1. Formation of microflora of the gastrointestinal tract 2. Types of microorganisms in the intestine, their role 3. Violations of microflora 4. Improvement of intestinal microflora 5. Methods for determining the intestinal microbiota		12-13
24.	The motor function of the digestive tract	1. The structure of the walls of various parts of the alimentary canal. 2. The mechanism of the act of chewing and swallowing. 3. Motor activity of the stomach. 4. Motor activity of the small and large intestines. 5. Regulation of the motility of the digestive tract.		12-13
25.	Protein metabolism and the mechanism of its regulation	1. The value of proteins and the characteristic feature of their chemical composition. 2. Specificity of protein synthesis in various tissues. 3. The dynamic state of anabolism and catabolism of proteins in the body. 4. Dissimilation of proteins in the body. Nitrogen balance. 5. Mechanisms of regulation of protein metabolism. 6. Drawing up a food ration		12-13
26.	Lipid metabolism and its regulation	1. The value of lipids in the body. 2. Absorption of fats. The role of bile in the digestion of fats. 3. Dissimilation of fats. 4. Interconversion of organic substances. 5. Regulation of fat metabolism. 6. Drawing up a food ration		13-14
27.	The role of vitamins in the life of the body	1. The role of vitamins. Hypovitaminosis, hypervitaminosis, vitamin deficiency. 2. Classification of vitamins. 3. The functional value of water-soluble vitamins. 4. The functional significance of fat-soluble vitamins.		13-14

		5. The body's daily needs for essential vitamins.		
28.	Physiology of nutritional needs and the problem of maintaining a normal body weight	1. Exchange of substances and energy. Types of exchange (basic, working, daily). 2. Unconditioned and conditioned reflexes of digestion. Age and individual characteristics. 3.Conditioned food reflexes to time, space and information. 4.Emotional food addiction and biological nutritional need 5. The role of behavior motivation in maintaining normal body weight.		13-14
29.	Energy exchange	1. Biochemical transformations are the basis of energy metabolism. 2. Research of the body's energy expenditures. 3. Assessment of the amount of energy consumption for consumed by the body O2 and released CO2. 4. Basic exchange. 5. Daily expenditure of energy for people of different professions. 6. Calculation of the basic exchange in tables		14-15
30.	Role of the kidneys in homeostasis	1. Function of the kidneys as the main organ of homeostasis. 2. The process of urine formation. 3. Composition of urine. 4. Antidiuretic mechanism for maintaining water-salt balance. 5. The role of the kidneys in the acid-base balance. 6. Regulation of urine formation.		1-2
31.	Renin-angiotensin system.	1. Functional significance of ASD 2. Components of the renin-angiotensin system 3. Secretion of renin, angiotensin and aldosterone, their control 4. The mechanism of action of the renin-angiotensin system in the regulation of blood pressure 5. RAS and Covid 19		2-3
32.	Features of urination in newborns.	1. Age features of the urinary system in children 2. Physiological aspects of urination in young children 3. Research methods		3-4

		4. Damage to the kidneys and urinary tract		
33.	Respiratory and metabolic alkalosis and acidosis.	1. Acid-base balance 2. Respiratory acidosis 3. Respiratory alkalosis 4. Metabolic acidosis 5. Metabolic alkalosis		4-5
34.	Buffer systems of blood.	1. The role of blood buffer systems in maintaining acid-base balance 2. Bicarbonate buffer system 3. Phosphate buffer system 4. Protein and hemoglobin buffer systems		5-6
35.	Adaptive reactions of the body	1. Characteristics and classification of adaptive mechanisms 2. Stressors and stages of body resistance 1. Nonspecific protective and adaptive reactions. 3. Specific adaptive reactions. 4. Adaptation to physical activity and hypokinesia 5. The essence of improving the adaptive physiological mechanisms.		6-7
36.	Biological rhythms	1. Characteristics of biorhythms and their classification 2. The biological clock 3. Biorhythms and performance		

1.4.3. Evaluative Assessment Tools

• Current and milestone (modular) control

The current control of students' knowledge can be:

- oral questioning;
- checking the completion of written homework;
- checking abstracts, essays, reports;

Topics of abstracts (essays, reports):

1. Physiological characteristics of the systemic activity of the organism. Theory functional systems, its basic provisions and nodal mechanisms.
2. A systematic approach to the study of purposeful human behavior in various living conditions.
3. Reflex and systemic organization of behavior.

4. Systemogenesis of the behavioral act.
5. Manifestations of human brain activity. Behavior and psyche.
6. Analytical and synthetic activity of the cerebral cortex. The teachings of I.P.
7. Pavlova on the dynamic stereotype.
8. Thinking, consciousness, speech. Conscious and unconscious. Perceptual defense.
9. Emotions, their characteristics, biological significance and objectification
10. Emotions and learning, education of emotions.
11. Theories of emotions.
12. Emotional stress and resistance to it. Medical aspects of emotions.
13. Chronic fatigue syndrome. Physiological mechanisms and consequences.
14. Motivation and its neurophysiological mechanisms.
15. Physiological basis of adaptation.
16. Modern ideas about the mechanisms of sleep and hypnosis.
17. Systemic mechanisms of pain. Phantom pain.
18. Antinociceptive system. Physiological bases of pain relief.
19. Biorhythmology. Discreteness of various processes in the body.
20. Physiological foundations of rational modes of work and rest. Ways to improve human performance.
21. Physiological basis for increasing the mental performance of a person.
22. Physiological foundations of rational diet.
23. External and internal barriers of the body. Barrier mechanisms functions.
24. Erythron. Regulation of erythropoiesis.
25. Blood substitution solutions. Modern problems of blood transfusiology.
26. Immunity, its types, characteristics. Assessment of the state of the immune system.
27. Coagulation, anticoagulant and fibrinolytic blood systems as the main apparatus of the functional system for maintaining its liquid state.

28. Organization of the functional respiratory system.
29. Physiological foundations of cardiac arrhythmias. Possible reasons cardiac arrhythmias.
30. Features of cerebral circulation and methods of its assessment.
31. A functional system that supports optimal metabolism blood pressure.
32. Functional "quanta" of urination and urination.
33. Osmo- and volume-regulating functions of the kidney.
34. Osmotic dilution and concentration of urine.
35. Ion-regulating, metabolic and excretory functions of the kidney.
36. AIDS is a disease of civilization.
37. Physiological changes in different variants of addictive behavior.
38. Tobacco smoking and its consequences

• **Final control**

The final control at the end of the study of an academic discipline is carried out in the form of a test, which is set on the basis of the results of midterm (modular)

- control in the class.
- control questions and tasks

1.4.4. Course policy and assessment criteria

The control of students' knowledge is carried out according to the point-rating system in accordance with the standard "Regulations on the modular point-rating system for assessing the knowledge of students at the NOU UNPK" International University of Kyrgyzstan ".

The discipline "Normal Physiology" includes 3/4 modules for the 1st and 2nd semesters, each module is evaluated on a 100-point system:

Maximum score -100, of which:

- attendance - 20 points;

- current control - 40 points (20 points - for classroom work, 20 points - for independent work),
- midterm control (delivery of the module) - 40 points.

The results of the modules for each semester are added up and the average score is displayed.

Scoring Policy	**Module 1**	**Module 2 etc.**
Attendance	20 points	20 points
Classroom work (activity in discussions, during oral questioning, working with a glossary, etc.)	20 points	20 points
Students' work: essay, report	20 points	20 points
Total by module (testing)	40 points	40 points
Total by discipline:	More than 60 points	
Зачет		

Final control in the form of offset is carried out based on the results of attendance, current and midterm (modular) control.

Final control form - credit / exam.

To assess the student's progress, the following scale of correspondence between grades and points is used:

Scale of correspondence of grades and points				
Maximum score	Intervals			
	«unsatisfactory»	«satisfactory»	«good»	«excellent»
20	0-11	12-15	16-17	18-20
40	0-23	24-30	31-35	36-40
60	0-35	36-45	46-53	54-60
100	0-59	60-75	76-89	90-100

1.4.5. Educational-methodical and informational support of the discipline

Main references:

1. Medical Physiology/ Pr. A.C. Guyton and Pr. J.E. Hall/ - Philadelphia – New York, 2000
2. Fundamentals of Human physiology/ L Sherwood/ 4th edition, 2012

3. Medical physiology/ JD Kibble, CR Halsey – 2009
4. Principles of Human physiology/ CL Stanfield – 5th edition, 2013
5. Review of Medical Physiology/ William F.Ganong/ McGraw-Hill – 20th edition, 2001
6. Human Physiology/ R.F. Schmidt and G. Thews/ - London – Paris – Tokyo – Hong Kong, 1996.
7. Human physiology/ SI Fox – 12th edition, 2009

Additional references:

1. Brass LF/ Thrombin and platelet activation. Chest 124 (3 Suppl). – 18S, - 2003
2. Caprini JA, Glase CJ, Anderson CB, Hathaway K/ Laboratory markers in the diagnosis of venous thromboembolism. Circulation 109 (12 Suppl 1) – 14, - 2004
3. Hemotopoietic stem cells/ Trigg ME// Pediatrics 113 (4 Suppl). – 1051, - 2004
4. Allman BL, Rice CL: Neuromuscular fatigue and aging: central and peripheral factors. Muscle Nerve 25:785, 2002
5. Amonof MJ: Electromyography in clinical practice. New York: Churchill Livingstone, 1998
6. Rekling JC, Func GD, Bayliss DA, e al: Synaptic control of motoneuronal excitability. Physiol. Rev. 80:767, 2000
7. Tang W, Sencer S, Hamilton SL: Calmodulin modulation of proteins involved in excitation-contraction coupling. Frnt Biosci 7:583, 2002
8. Morris AJ, Malbon CC/ Physiological regulation of g protein-linked signaling// Physiol. Rev. 79:1373, 1999
9. Albright TD, Jessell TM, Kandell ER, Posner MI: Progress in the neural sciences in the century after Cajal (and the mysteries that remain). Ann NY Acad Sci 929:11, 2001
10. Burmester T, Hankeln T: Neuroglobin: a respiratory protein of the nervous system. News Physiol. Sci 19:110, 2004

11. Chesler M: Regulation and modulation of pH in the brain. Physiol. Rev. 83:1183, 2003
12. Kenney WL, Munce TA: Aging and human temperature regulation. J. Appl. Physiol. 95:2598, 2003
13. Fuchs F, Smith SH: Calcium, cross-bridges, and the Frank-Starling relationship. News Physiol. Sci 16:5, 2001
14. Fossard Ha: Calcium sodium and calcium channels: a history of excitatory currents. Cardiovasc. Res. 55:1, 2002
15. Daniels CB, Orgeig S: Pulmonary surfactant: the key to evolution of air breathing. News Physiol. Sci 18:151, 2003
16. Sant'Ambrogio G, Widdicombe J: Reflexes from airway rapidly adapting receptors. Respir. Physiol. 125:33, 2001
17. Johnson LR: Gastrointestinal Physiology, 6th ed. St.Louis: Mosby, 2001
18. Bouret SG, Simerly RB: Leptin and development of hypothalamic feeding circuits. Endocrinology 145:2621, 2004

The list of resources of the information "Internet" necessary for mastering the discipline:

- www.kyrlibnet.kg.
- www.iprbookshop.ru.
- www.consilium-medicum.com.
- www.medportal.ru.
- www.studmedlib.ru.

1.4.6. Logistics of the discipline

When teaching students, she applies modern methods and forms of education using the latest information technologies, electronic educational resources and other information systems necessary for the successful implementation of educational, scientific and medical activities.

The classrooms of the course are equipped with modern and innovative facilities to provide quality education to students. The lecture halls are equipped with computers, video projectors and sound systems, allowing lectures to be conducted at a high professional level. There is also portable equipment for teaching staff in the form of laptops and projectors for convenient presentation of educational material in electronic format.

1.4.7. Student research work

SRW in the discipline "Normal physiology" is aimed at solving the following problems:

- -development of skills of perception and analysis of fundamental and professional information;
- -development and improvement of the ability to make decisions and implement them;
- -development and improvement of creative abilities in the independent study of professional problems.

To solve the first problem, students are invited to read and meaningful analysis of scientific monographs and articles on various issues of public health contained in the list of resources of the information and telecommunications network "Internet":

https://www.euro.who.int/en/health-topics/Health-systems/public-health-services/public-health-services
https://www.cdcfoundation.org/what-public-health
https://www.researchgate.net/journal/Public-Health-Monograph-0079-7596
https://www.journals.elsevier.com/public-health

The results of work with scientific monographs and articles are discussed in practical classes.

To develop and improve the communication skills of students, special training sessions are organized in the form of work in small groups, "brainstorming",

discussions, presentations, or, in preparation for which, students are assigned in advance into groups defending a particular point of view on the problem under discussion.