



SYLLABUS ON THE DISCIPLINE «PHYSIOLOGY»

1. General information	
Faculty	Pharmacy
Educational program (<i>field, speciality, level of high education, form of education</i>)	22 Health care, 226 Pharmacy, industrial pharmacy, the second (master) degree of higher education, full-time
Academic year	2022-2023
Name of discipline, code (<i>electronic identification at the Danylo Halytskyi Lviv National Medical University website</i>)	Physiology https://new.meduniv.lviv.ua/kafedry/kafedra-normalnoyi-fiziologiyi/
Department (<i>name, address, phone, e-mail</i>)	Department of Normal Physiology 70010, Lviv, 69 Pekarska +38(032)2786445, +38(032)2603007 kaf_normphysiology@meduniv.lviv.ua
Head of the Department (<i>contact e-mail</i>)	Zayachkivska O.S., MD, PhD, DSc (in Medicine), Professor ozayachkivska@gmail.com
Educational year (<i>year of the discipline study</i>)	I
Semester (<i>semester of the discipline study</i>)	II
Type of the discipline/module (<i>mandatory / optional</i>)	Mandatory
Teaching staff (<i>names, surnames, scientific degrees and titles, of the teaching staff, emails</i>)	Prof. Zayachkivska O.S., MD, PhD, DSc, ozayachkivska@gmail.com Ass. Prof. Chupashko O.I., MD, PhD, olesyach0210@gmail.com Ass. Prof. Pinyazhko R.O., MD, PhD, pinyazhko.roman@gmail.com Ass. Prof. Savytska M.Y., MD, PhD, merymed11@gmail.com Ass. Prof. Sukhodolska N.V., MD, PhD, natalia.suhodolska@gmail.com Ass. Muzyka I.V., MD, iryna.muzyka2912@gmail.com Ass. Karhut S.T., MD, sofiakarkhut@gmail.com
Erasmus yes/no (<i>availability of discipline for students within the program Erasmus+</i>)	No
The person responsible for the syllabus (<i>the person to whom comments on the syllabus should be given, e-mail</i>)	Sukhodolska N.V., natalia.suhodolska@gmail.com Zayachkivska O.S., ozayachkivska@gmail.com
Number of ECTS credits	4
Number of hours (<i>lectures / practical classes / self-reliance work</i>)	120 (14/46/60) Lectures - 14 hours Practical classes - 46 hours Self-education work - 60 hours
Language of studying	English
Information on the consultations	According to the schedule
Address, telephone and rules of operation of the clinical base, office (<i>if necessary</i>)	
2. Brief review of the discipline	
<p>Physiology is the science of the general laws of the functions of a living organism at all levels of its organization: cellular, tissue, at the level of organs, organ systems and the whole organism; the relationship of functions, regulatory mechanisms, adaptation to changes in the environment, origin and development in the process of evolution and individual development.</p> <p>Physiology as a discipline:</p> <p>a) provides training for specialists - clinical pharmacists who have a significant amount of theoretical and practical</p>	

knowledge about the structural and functional features of the organism at different levels of its organization;

b) is based on the study by students of medical biology, medical and biological physics, medical and bioorganic chemistry, morphological disciplines and integrates with these disciplines;

c) is the basis for mastering pharmacology, microbiology, basics of pathological physiology and special pharmaceutical disciplines: pharmacognosy, pharmaceutical chemistry, pharmaceutical technology, which involves the integration of teaching with these disciplines and the formation of skills in physiology in further education and professional activities;

d) establishes an understanding of the concept of health, healthy lifestyle and prevention of dysfunction in the process of life.

3. Aim and goals of the subject

1) *The aim* of the course “Physiology” is to study the functions and mechanisms of interaction of cells, tissues, organs and systems in general. The main objectives of the discipline are systematic and integrative approach to the study of the physiological processes, functions of individual organs, systems and the whole organism; study of the mechanisms of nervous, humoral, cytokine regulation of the body, its functional systems; understanding of physiological mechanisms of interaction of organs and their systems; study of mechanisms of self-regulation of physiological processes in the body and physiologically bases of correction of their disorders; formation of students' practical skills in determining and assessing the functional state of the organism, instrumental and laboratory research methods; expanding the understanding of the role of studying human physiology for other medical disciplines, as well as pharmacology and special pharmaceutical disciplines.

2) *The ultimate goals* of discipline:

- *Interpret the mechanisms and laws of functioning of excitable structures of the body.*
- *Make conclusions on the state of physiological functions, its systems and organs.*
- *Analyze age-related features and functions of organism and their regulation.*
- *Analyze regulated parameters and make conclusions about the mechanisms of neural, humoral, cytokine regulation of physiological functions of the body and its systems.*
- *Analyze the health of a person during different conditions based on physiological criteria.*
- *Analyse the state of sensory processes in ensuring human life.*
- *Explain the physiological basis of methods for investigation of human body functions.*
- *Interpret the integrative mechanisms of the body.*
- *Analyze functional states of organism and explain their pharmacological correction.*

Knowledge:

1. Physiological mechanisms and patterns of human body functions and their neuro-humoral control;
2. Physiological norms of vital signs of the human body and their deviations under the influence of exogenous and endogenous factors;
3. Physiological bases of methods of laboratory and instrumental researches.
4. Physiological mechanisms of pharmacological correction of the functional state of visceral systems;
5. Basic principles of pharmacological correction of major functional disorders;
6. Causes and consequences of disorders of physiological processes in order to understand the effective choice of drug correction for successful treatment of patients;
7. Impacts of negative environmental factors on human health and ways to prevent them;
8. Modern trends in science and medicine, including pharmaceuticals, using information and communication technologies.

Skills:

1. Describe and explain the mechanisms of functioning of physiological systems of the human body and their regulation;
2. Interpret homeostatic parameters and their deviations;
3. Correctly choose adequate diagnostic methods for comprehensive and effective assessment of human health;
4. Assess the condition of visceral systems and analyze the impact of pharmacological correction of disorders of their functioning;
5. Determine the parameters of body functions and analyze the basics of their pharmacological correction;
6. Assess the nature of the cause-and-effect relationships of functional disorders for adequate selection of appropriate pharmacological agents;
7. Assess the degree of impact of negative environmental factors on health and identify groups and risk factors;
8. Analyze the acquired knowledge for the organization and implementation of scientific and professional activities.

Autonomy and responsibility:

1. Responsibility for the timely and continuous acquisition of modern knowledge;
2. Responsibility for the quality of performed work and results;

3. Responsibility for professional development, ability to further professional education with a high level of autonomy;
4. Responsibility for the personal and social health;
5. Responsibility for moral and ethical principles in professional activities.

3) *Competences and learning outcomes*, the formation of which provides the study of physiology. The course provides the students' competences according to the requirements of the High education standard:

General:

- GC 1. Ability to act socially responsibly and consciously;
- GC 2. Ability of using the acquired knowledge in practical situations;
- GC 3. The desire to preserve the environment;
- GC 4. Ability to abstract thinking, analysis and synthesis, learn and be modern trained;
- GC 5. Ability to show initiative and entrepreneurship;
- GC 6. Knowledge and understanding of the subject area and understanding of professional activity;
- GC 7. Ability to adapt and act in a new situation;
- GC 8. Ability to communicate in the state language both orally and in writing, ability to communicate in a foreign language (mainly English) at a level that ensures effective professional activity;
- GC 9. Ability to use of information and communication technologies;
- GC 10. Ability to choose communication strategy, ability to work in a team and with experts from other fields of knowledge / economic activities;
- GC 11. Ability to assess and ensure the quality of work performed;
- GC 12. Ability to conduct research at the appropriate level;
- GC 14. Ability to preserve and increase moral, cultural, scientific values and achievements of society based on understanding the history and patterns of development of the subject area, its place in the general system of knowledge about nature and society and in the development of society and technology, use different types and forms of physical activity for active rest and healthy live.

Professional:

- PC 1. Ability to conduct sanitary and educational work among the population to prevent common diseases, prevent dangerous infectious, viral and parasitic diseases, as well as to facilitate the timely detection and maintenance of adherence to treatment of these diseases according to their medical and biological characteristics and microbiological features;
- PC 3. Ability to provide first aid to patients and victims in extreme situations and emergencies;
- PC 4. Ability to ensure rational use prescription and over-the-counter medicines and other products of the pharmacy range in accordance with physicochemical, pharmacological characteristics, biochemical, pathophysiological features of a particular disease and pharmacotherapeutic schemes of its treatment;
- PC 6. Ability to determine drugs, xenobiotics, toxins and their metabolites in body fluids and tissues, to conduct chemical and toxicological studies to diagnose acute poisoning, narcotic and alcohol intoxication.

4. Prerequisites of the discipline

Physiology is a fundamental medical discipline based on knowledge of biology, medical and biological physics, medical chemistry, biological and bioorganic chemistry, human anatomy, histology, cytology and embryology.

5. Program results of study

List of the study results

Code of the learning outcomes	The content of the learning outcomes	Link to the competencies matrix code
<i>Code is created while filling out the syllabus (categories: Kn – knowledge, Ab – ability, C – competence, AR – autonomy and responsibility)</i>	<i>Results of study determine what student must know, understand and be able to perform, after completing the discipline. Learning outcomes follow from the set learning goals. It is necessary to confirm the achievements of each result of study to enroll in the discipline.</i>	Symbol of the Program Result of Study Code in the Higher Education Standard
Kn-8; Ab-2,4-6,8; AR-1-5; GC-1-12; PC-1,3	Know moral and deontological principles and professional rules in work, in interaction with colleagues, management, consumers, and work effectively in a team. Be able to assess the psycho-emotional state of consumers, colleagues for effective cooperation and achieving the desired result. Be able to determine the purpose and goals of professional and personal development using modern knowledge and skills.	PR-1
Kn-1-8; Ab-1-8; AR-1-5; GC-1-4,6-9,11,12,14; PC-1,3,4,6	Know the physiological mechanisms, patterns of functions and the human body at all levels of its organization, and their neuro-humoral control, Be able to	PR-2

	analyze the basic physiological parameters of a healthy body. Master the physiological basis of methods of laboratory and instrumental studies of body functions.	
Kn-1-8; Ab-1-8; AR-1,3; GC-1-12,14; PC-6	Know the modern trends in science and medicine, including pharmaceuticals, using information and communication technologies.	PR-9
Kn-1-8; Ab-1-8; AR-1-5; GC-2,4; PC-1,3,4,6	Know the mechanisms of changes in the number and sensitivity of specific receptors, activity of neurotransmitter systems, as well as circadian, seasonal rhythms of physiological processes, including hormone secretion, fluctuations in gastric pH, absorption activity in the small intestine, etc. to understand the effectiveness of drugs depending on the on the state of the organism.	PR-16

6. Course format and scope

Discipline format (full-time or part-time)	Full-time	
Type of classes	Number of hours	Number of groups
Lectures	14	
Practical classes	46	
Seminars	-	
Self work	60	

Code of class type	Topic	Content	Learning outcome code	Teaching staff
L-1	Subject, tasks and principles of physiology. The concept of experiment and research methods. Physiology of excitable tissues.	Introduction to the course of physiology. Principles of physiology. Methods of physiological research. Excitable tissues. Biopotentials. Physiological role of membrane resting potential (MPS) and action potential (PD). The mechanism of muscle contraction and relaxation of skeletal and smooth muscle fibers. Blockers of membrane channels, receptors, sodium-potassium pump. Methods of blocking neuromuscular transmission.	Kn-1-3, 5-8; Ab-1-6,8; AR-1; GC-4, 6-9; PC-4	Prof. Zayachkivska O.S. / Ass. Prof. Savytska M.Ya.
L-2	Physiology of the CNS and ANS. Physiology of sensory systems and higher integrative functions.	Excitation and inhibition in the CNS. Principles of coordination of reflex activity. The role of different parts of the CNS in the regulation of motor functions. Structural and functional organization of the ANS. Nervous regulation of visceral systems. The concept of sensory systems. Receptors: classification, basic properties, excitation mechanisms, functional lability. Conducting pathways, cortical part of sensory systems. Nociceptive system. Physiological significance of pain. Antinociceptive system, opiate and non-opiate mechanisms. Physiological bases of medical anesthesia. Higher integrative functions. Conditioned reflexes. Memory. The role of motivation, emotions in human behavior.	Kn-1-3, 5-8; Ab-1-6,8; AR-1; GC-4, 6-9; PC-4	Prof. Zayachkivska O.S. / Ass. Prof. Savytska M.Ya.
L-3	Physiology of the endocrine system. The role of hormones in the regulation of homeostasis and	Humoral regulation, its factors, mechanisms of action of hormones on target cells, regulation of hormone secretion. Hypothalamic-pituitary system. The role of hormones in the regulation of	Kn-1-8; Ab-1-8; AR-1,3,4; GC-4, 6-9, 12,14;	Ass. Prof. Chupashko O.I. / Ass. Prof. Pinyazhko R.O.

	nonspecific adaptation of the organism. Humoral regulation of body temperature and metabolism.	mental, physical development and linear growth of the body, in the regulation of adaptation of the organism, in the regulation of homeostasis (hormones of the thyroid gland, parathyroid glands, pancreas, adrenal cortex). The role of hormones in thermoregulation. The effect of hormones on metabolism.	PC- 4	
L-4	Physiology of the blood system. Specific and nonspecific factors of immune protection. Antigenic properties of blood.	General characteristics of the blood system. Blood as a transport system and the internal environment of the body. Blood plasma parameters. Erythrocytes, functions. Hemoglobin, hemoglobin compounds, hemoglobin oxygen saturation. Blood groups. Leukocytes, formula. The role of T- and B-lymphocytes.	Kn-1-8; Ab-1-8; AR-1-5; GC-2, 4-9; PC-1,3,4,6	Prof. Zayachkivska O.S. / Ass. Prof. Savytska M.Ya.
L-5	Respiratory system. The main stages of respiration. Respiratory regulation.	External respiration. Respiratory cycle. Pulmonary ventilation. Methods of assessment of external respiration. Parameters of external respiration. Gas exchange in the lungs. Transportation of gases by blood. Oxygen capacity of blood. Regulation of respiration. Respiration under conditions of low and high atmospheric pressure Pharmacological correction of bronchial lumen.	Kn-1-8; Ab-1-8; AR-1-5; GC-2, 4-9; PC-1,3,4,6	Ass. Prof. Savytska M.Ya. / Ass. Prof. Chupashko O.I.
L-6	Physiology of cardiovascular system. Basic principles of hemodynamics. Regulation of systemic circulation. Pharmacological correction of cardiovascular disorders.	Cardiovascular system. Physiological properties of the heart muscle. ECG. Phases of cardiac activity, heart tones. The role of blood vessels in blood circulation. Blood pressure, factors that affect blood pressure. Auscultatory method of blood pressure measurement. Regulation of blood circulation. Physiological bases of drug correction of heart disorders, vascular tone.	Kn-1-8; Ab-1-8; AR-1-5; GC-2, 4-9; PC-1,3,4,6	Ass. Prof. Sukhodolska N.V. / Ass. Prof. Chupashko O.I.
L-7	Physiology of the digestive and renal systems. Principles of regulation of the functions of the digestive and renal systems. Pharmacological correction of the functions of the digestive and renal systems.	Digestion in the oral cavity. The role of taste and olfactory sensory systems. Digestion in the stomach. Regulation of secretory and motor function of the stomach. Digestion in the duodenum, the role of the pancreas and liver in digestion, regulation of their functions. Regulation of secretory and motor functions of the intestine. Absorption. Physiological bases of pharmacological correction of digestive system disorders. The role of the kidneys in the processes of excretion. Mechanisms and regulation of urination. The role of kidneys in maintaining homeostasis. Diuretics, mechanisms of action.	Kn-1-8; Ab-1-8; AR-1-5; GC-2, 4-9; PC-1,3,4,6	Ass. Prof. Savytska M.Ya. / Prof. Zayachkivska O.S.
P-1	Investigation of bioelectrical properties of excitable tissues.	Structure and functions of the cell membrane. Types of transmembrane transport. Irritability, excitability as the basis of tissue response to irritation. Excitation. Membrane resting potential (MRP), mechanisms, MRP parameters. Action potential (AP), mechanisms of	Kn-1-3, 5-8; Ab-1-6; AR-2; GC-2, 4, 6-9; PC- 4	All teachers

		origin, methods of registration, phases of AP, parameters of AP. Physiological role of MRP and AP. Changes in cell excitability during AP. Periods of absolute and relative refractoriness, mechanisms of their origin, physiological significance. Local response. Excitability parameters. Laws of irritation of excitable tissues. Influence of Na ⁺ / K ⁺ -ATPase inhibitors on MRP, blockers of sodium channels on AP.		
P-2	Structural and functional features of nerve fibers. Investigation of physiological properties of nerve fibers, excitation transmission through neuromuscular synapse.	Physiological properties of nerve fibers. Classification of nerve fibers. Mechanisms of excitation by nonmyelinated and myelinated nerve fibers. Laws of excitation by nerve fibers. The speed of excitation, the factors on which it depends. Characteristics of nerve fibers type A, B, C. Influence of local anesthetics on AP generation. General structure of synapses. Features of the structure and functions of the neuromuscular synapse compared with the neuro-neuronal. The mechanism of transmission of excitation through the neuromuscular synapse. Presynaptic processes, neurotransmitters, receptors and postsynaptic processes. N-cholinoreceptor blockers. Methods of blocking neuromuscular transmission.	Kn-1-3, 5-8; Ab-1-6; AR-1,2; GC-2, 4, 6-9; PC-4	All teachers
P-3	Structural and functional features of muscles. Research of physiological properties of muscles. Mechanism of muscle contraction.	Physiology of muscles. Mechanisms of skeletal muscle contraction and relaxation. Mechanisms of excitation and contraction in muscle fibers. Functions and properties of skeletal muscles. Types of muscle fibers. Types of muscle contraction depending on the frequency of irritation: single, tetanic. Types of muscle contraction depending on changes in their length and tension: isometric, isotonic. Motor units. Electromyography. Muscle strength and function. Dynamometry. The role of ATP in the contraction and relaxation of muscle fibers. Smooth muscle physiology. Mechanisms of smooth muscle contraction and relaxation. Mechanisms of combination of excitation and contraction in smooth muscle fibers. Functions and properties of smooth muscles. Muscle contraction energy. Features of excitation, contraction of smooth muscles and comparison with skeletal.	Kn-1-8; Ab-1-8; AR-1,2,4; GC-2,4, 6-9; PC-4	All teachers
P-4	Investigation of nervous regulation of physiological functions. The processes of excitation and inhibition in the	Biological regulation, its types, contours, regulated parameters, the role of feedback in the contour of biological regulation. Nervous regulation of functions. Neuron as a structural and functional unit of the CNS. Types of neurons, their functions. CNS	Kn-1-3, 5-8; Ab-1-3, 5-8; AR-1; GC-2, 4, 6-9; PC-4,6	All teachers

	CNS.	neurotransmitters. The mechanism of transmission of excitation and inhibition in the CNS. Postsynaptic and presynaptic inhibition. Neural circuits. Types of inhibitions in neural networks, their role. Reflex, reflex arc, functions of its links, mechanisms of coding and transmission of information by the links of the reflex arc. The role of receptors. Nerve centers and their physiological properties Principles of reflex coordination. Types of reflexes, their physiological significance.		
P-5	The role of different parts of the CNS in the regulation of motor functions of the body.	Motor systems of the spinal cord. Types and physiological characteristics of proprioceptors: muscle spindles or stretch receptors, Golgi tendon organs. Stretching reflexes (myotatic), their reflex arcs, gamma-loop functions. Clinical significance of myotatic reflexes. Conductive and sensory functions of the spinal cord. The role of the midbrain, hindbrain and reticular formation in the regulation of motor functions. Functional and structural organization of the cerebellum, its afferent and efferent connections, their physiological role. Functional organization of the cerebellar cortex. Interaction between cerebellar cortex, cerebellar nuclei and CNS structures. Functional characteristics of thalamic nuclei and basal ganglia in the regulation of motor functions. Neurotransmitters in the system of basal ganglia, their physiological role. The role of the cerebral cortex in the formation of systemic activity of the organism.	Kn-1-3, 5-8; Ab-1-3, 5-8; AR-1; GC-2, 4, 6-9; PC-4,6	All teachers
P-6	Structural and functional organization of ANS. Investigation of the mechanisms of neural control of autonomic functions.	Structural and functional organization of the autonomic nervous system. Sympathetic, parasympathetic and enteric divisions, their role in the regulation of visceral functions. Central regulation of visceral functions. Hypothalamus, its afferent and efferent connections. The role of the hypothalamus in the regulation of visceral functions. Centers of sympathetic and parasympathetic departments of the ANS. Autonomic ganglia, their functions. Mechanisms of excitation transmission and inhibition in synapses of sympathetic and parasympathetic systems of ANS. Types of cytoreceptors (cholinergic, adrenergic, purinergic, serotonergic and others). Agonists and antagonists of ANS synapses. Sympathetic and parasympathetic effects on organ	Kn-1-6, 8; Ab-1-8; AR-1,2,4; GC-2, 4, 6-9, 14; PC-1,3,4,6	All teachers

		functions.		
P-7	Structural and functional organization of sensory systems. Physiological bases of pain and anesthesia.	<p>The concept of sensory systems. Structural and functional organization of sensory systems. Receptor potential. Regulation of receptor function. Methods of research of receptor excitability. Conducting paths: specific and nonspecific channels of information transmission. Participation of spinal cord structures, brainstem, thalamus in conducting and processing of afferent excitations. Thalamus as a collector of afferent pathways. Coding of information and its processing in different parts of the sensory system. Physiological bases of methods of research of sensory systems. Age-related changes in sensory systems. Structural and functional organization of the somatosensory system. Physiological basis of pain. Nociception, physiological characteristics and classification of nociceptors. The physiological significance of pain. Antinociceptive or analgesic system, opiate and non-opiate mechanisms, physiological role. Physiological bases of anesthesia.</p>	Kn-1-8; Ab-1-8; AR-1, 4; GC-2, 4, 6-9, 14; PC-1,3,4	All teachers
P-8	Investigation of physiological bases of behavior. The role of motivations and emotions in behavior. Higher integrative functions.	<p>Higher nervous activity. Physiological bases of behavior. Learning and memory, its types, mechanisms. Needs and motivations, their physiological mechanisms, the role in behavior. Emotions, their types, mechanisms of formation, biological role. Types of higher nervous activity, their classification, physiological basis, research methods. Types of nervous system and types of temperament in humans.</p>	Kn-1-6; Ab-1-3, 5-8; AR-2-5; GC-1-12, 14; PC-1,3,6	All teachers
P-9	Investigation of the mechanisms of humoral regulation of autonomic functions.	<p>Factors of humoral regulation, their characteristics and classification. Contour of humoral regulation, the role of feedback in regulation. Classification of hormones. Endocrine glands, endocrine cells, their hormones and significance. The main mechanisms of action of hormones. Membrane and intracellular receptors, G-proteins, secondary messengers (cAMP, cGMP, I₃F/DAG, Ca²⁺), their role. Regulation of hormone secretion. Hypothalamic-pituitary system. The role of liberins and statins. Adenohypophysis, its hormones, their effects. Para- and autocrine action of biologically active substances. The role of somatotropin or growth hormone and insulin-like growth factors I and II (IGF-I, IGF-II) in growth and development. Thyroid hormones: thyroxine (T₄) and triiodothyronine (T₃).</p>	Kn-1-8; Ab-1-8; AR-1-5; GC-2, 4, 6-9; PC-1,3,4,6	All teachers

		Mechanisms of action on target cells, effects, effects of hypo- or hypersecretion. Pancreatic hormones (insulin, glucagon), their effects on metabolism and blood glucose concentration. Calcium balance in the body and hormones that regulate calcium and phosphate homeostasis: parathyroid hormone, calcitonin, calcitriol or $1.25(\text{OH})_2\text{D}_3$. The role of vasopressin, oxytocin. Hormones of the adrenal cortex (aldosterone, cortisol), their role in the body, regulation of secretion.		
P-10	Investigation of metabolism and energy. Basic metabolism. Thermoregulation. Mechanisms for maintaining the human body temperature. Physiological bases of nutrition.	General concepts of metabolism in the body. Energy metabolism. The body as an open thermodynamic system Energy balance of the body. Caloric value of various nutrients (physical and physiological). Direct and indirect calorimetry Caloric equivalent of oxygen. Respiratory quotient. The basal metabolic rate, its research. Specific-dynamic action of nutrients. The role of hormones in the regulation of metabolism. Investigation of basic and total energy exchange. Human body temperature, its daily fluctuations. Muscular and chemical thermogenesis. The role of individual organs in heat production. Heat transfer. Methods of heat loss from the body surface (radiation, conduction, convection, evaporation). Physiological mechanisms of heat loss (blood flow in the vessels of the skin, sweating, etc.). Thermoregulation. Peripheral and central thermoreceptors. Nervous and humoral mechanisms of thermoregulation. Regulation of body temperature with changes in ambient temperature. The role of hormones in thermoregulation. Physiological bases of nutrition.	Kn-1-8; Ab-1-8; AR-1-4; GC-2, 4, 6-9; PC-1,3,4,6	All teachers
P-11	Investigation of physical and chemical properties, transport, protective and antigenic functions of blood.	The concept of the blood system. The main functions of the blood. The composition and volume of blood in humans. Hematocrit. Basic physiological constants of blood, mechanisms of their regulation. Plasma, its composition, the role of plasma proteins. Osmotic and oncotic pressures. Regulation of osmotic pressure. Acid-base balance, the role of buffer systems in the regulation of its stability. Erythrocytes, structure, number, functions. Hemoglobin, its structure, properties, types, compounds. The amount of hemoglobin. Criteria for saturation of erythrocytes with hemoglobin: color index. Hemolysis, its types. Erythrocyte sedimentation rate (ESR), factors influencing it. Blood	Kn-1-8; Ab-1-8; AR-1-4; GC-2, 4, 6-9; PC-1,3,4,6	All teachers

		<p>groups: ABO, CDE systems, others. Methods for determining blood groups using standard sera and coliclons. Physiological basis of blood transfusion. Rules of blood transfusion. Blood substitutes. Leukocytes, their number, types. The concept of leukocytosis and leukopenia leukocyte formula. Functions of different types of leukocytes. Physiological bases of immunity. Regulation of the number of leukocytes. Functional significance of antibodies.</p>		
P-12	<p>Investigation of external respiration. Respiration in different environmental conditions. Regulation of respiration.</p>	<p>Structure and functions of the respiratory system. The main stages of the respiratory process. External respiration. Physiological characteristics of the respiratory tract, their functions. Non-respiratory lung function. Biomechanics of inhalation and exhalation. Pressure in the pleural cavity, in the alveoli, their changes during inhalation and exhalation. Elastic properties of the lungs and chest walls. Surface tension of alveoli, the mechanism of its reduction. Surfactants, their significance. Static and dynamic indicators of external respiration. Spirometry, spiropgraphy, pneumotachometry. Mechanisms of gas exchange between inhaled air and alveolar gas mixture, between alveoli and blood in the pulmonary capillaries. Diffusion capacity of the lungs. CNS structures that provide respiratory periodicity. Structures of the hindbrain: dorsal respiratory group of neurons, its role in the generation of the main rhythm of respiration and regulation of respiration; ventral respiratory group of neurons, its role. Protective respiratory reflexes. Regulation of airway resistance. Breathing at high and low barometric pressure.</p>	<p>Kn-1-8; Ab-1-8; AR-1-4; GC-2, 4, 6-9; PC-1,3,4,6</p>	All teachers
P-13	<p>Investigation of physiological properties of heart and mechanisms of regulation of cardiac activity.</p>	<p>General characteristics of CVS system. Physiological properties of the myocardium and their features. Automaticity of the heart. The action potential of atypical cardiomyocytes of the heart driver - sino-atrial node. Conductive system of the heart. Action potential of typical cardiomyocytes. Refractory periods. Mechanisms of cardiomyocyte contraction and relaxation. Dynamics of cardiac excitation. Physiological bases of electrocardiography. ECG analysis. Regulation of cardiac activity: myogenic, nervous, humoral. Positive and negative chrono-, ino-, dromo-, bathotropic effects. Mechanisms of influence of parasympathetic and sympathetic nerves on the physiological properties of the</p>	<p>Kn-1-8; Ab-1-8; AR-1-4; GC-2, 4, 6-9; PC-1,3,4,6</p>	All teachers

		heart muscle. Neurotransmitters of postganglionic parasympathetic and sympathetic nerve fibers. Cytoceptors, secondary mediators, effects. Influence of agonists and blockers of M-cholinoreceptors and β -adrenoceptors. Mechanisms of influence of ionic composition of blood plasma on heart activity: hypo- and hyperkalemia, hypo- and hypercalcemia. Mechanisms of influence of hormones on heart activity: catecholamines, thyroxine and triiodothyronine, glucagon, etc.		
P-14	Investigation of blood pressure. Regulation of blood circulation. Physiological bases of hemodynamics.	Blood pressure: arterial (systolic, diastolic, pulse, mean), capillary, venous. Factors that determine the blood pressure. Physiological bases of blood pressure measurement in clinical practice. Arterial pulse, its main parameters. Systemic circulation. Basic laws of hemodynamics. The mechanism of vascular tone. Total peripheral vascular resistance. Linear and volumetric velocities of blood in different parts of the vascular bed. Functional classification of blood vessels. Microcirculation. Cardiovascular center, its structure, afferent and efferent connections. The main reflexogenic zones, baroreceptors and chemoreceptors of the carotid sinus and aortic arch, their role. Reflexes from the receptors of the atria and large veins. Pressor and depressor reflexes. Nervous and humoral mechanisms of blood pressure regulation. Regulation of blood circulation during changing body position. Regulation of blood circulation during physical activity.	Kn-1-8; Ab-1-8; AR-1-5; GC-2, 4, 6-9; PC-1,3,4,6	All teachers
P-15	Investigation of digestion in oral cavity, stomach and intestines.	Functional organization of digestive system. The main functions of the digestive system: secretion, motility, absorption. Digestion: its types (cavity, membrane, intracellular), the main stages. Digestion in oral cavity. Mechanical and chemical digestion. Salivation. The amount, composition and properties of saliva, its importance in digestion, mechanisms of secretion (primary, secondary saliva). Ionic composition of saliva, saliva pH. Regulation of saliva secretion. Bases of eating behavior. The role of the taste sensory system. Receptor, conduction and cortical parts. Types of taste sensations, importance for digestion, interaction with the olfactory sensory system. Secretory activity of gastric glands. Composition and properties of gastric juice. Mechanisms of secretion of	Kn-1-8; Ab-1-8; AR-1-5; GC-2, 4, 6-9; PC-1,3,4,6	All teachers

		<p>hydrochloric acid, enzymes, mucus and their regulation. Nervous and humoral regulation of gastric secretion, phases of secretion regulation. Adaptive changes in gastric secretion. Motor function of the stomach, its regulation.</p> <p>Exocrine activity of the pancreas. The amount, composition and properties of pancreatic juice, its role in digestion. Nervous and humoral regulation of pancreatic secretion. The role of the liver in digestion. Bile formation, its composition and properties. Involvement of bile in digestion. Regulation of bile formation and its secretion into the duodenum. Intestinal secretion, composition and properties of intestinal juice, its role in digestion. Types of motility, its regulation. The role of the enteric system in the regulation of secretory and motor function of the intestine. The role of intestinal microbiota. Absorption processes. Research methods. Absorption of substances in different parts of the digestive tract, its mechanisms. Features of absorption of water, salts, carbohydrates, proteins, fats, vitamins and other substances. Absorption regulation.</p>		
P-16	Investigation of excretory processes. The role of the kidneys in the homeostasis and homeokinesis.	<p>Renal system, its structure, functions. Excretory organs (kidneys, skin, lungs, digestive tract), their participation in maintaining of homeostasis. Kidneys as the main organs of the excretory system. Nephron as a structural and functional unit of the kidney. Circulation in the kidney, its features. The main processes of urine formation: filtration, reabsorption, secretion. Filtration mechanisms, composition of primary urine. Filtration regulation. Reabsorption in tubules, its mechanisms.</p> <p>Countercurrent multiplier system, its role. Secondary urine, its composition, quantity. Renal clearance and determination of filtration rate, reabsorption, secretion, renal plasma circulation and blood circulation. The role of the kidneys in maintaining nitrogen balance, homeostasis parameters. Regulation of osmotic pressure of the internal environment, the role of vasopressin. Mechanisms of thirst. Regulation of the concentration of sodium and potassium ions, water volume and circulating blood in the body with the participation of the kidneys: the role of renin-angiotensin-aldosterone system (RAAS), natriuretic hormone. Regulation of the concentration of</p>	Kn-1-8; Ab-1-8; AR-1-5; GC-2, 4, 6-9; PC-1,3,4,6	All teachers

		calcium ions and phosphates with the participation of the kidneys. The role of the kidneys in the regulation of the acid-base balance. Incretory function of the kidneys. Targets and mechanisms of action of diuretics.		
SW-1	The main stages of development and formation of physiology as a scientific basis of medicine.	Characteristics of the development of physiology. The role of the works of W. Harvey, R. Descartes. Formation and development of physiology in the XIX and early XX centuries (K. Bernard, E. du Bois-Reymond, W. Cannon, K. Ludwig, K. Landsteiner, B. Einthoven, C. Sherrington). The achievements of the Nobel Prize winners in physiology and medicine in recent years.	Kn-8; Ab-8; AR-3; GC-1, 8, 9	All teachers
SW-2	Contribution of works by I. Mechnikov, O.O. Bogomolets, R.E. Kavetsky, S. Komisarenko and others in the development of world physiology.	The contribution of the works of I. Mechnikov, V. Pravdych-Neminsky, R. E. Kavetsky, S.V. Komissarenko in the development of world physiology. Ukrainian School of Physiology - V.Ya. Danilevsky, V.Yu. Chagovets, D.S. Vorontsov, P.M. Serkov, P.G. Kostyuk, V.I. Skok, M.F. Shuba, G.V. Folbort, VV Frolkis, P.G. Bogach, O.O. Moybenko. Lviv School of Physiology - A. Beck, L. Popelsky, V. Radzievska, A. Vorobyov, Ye. Sklyarov, E. Panasyuk.	Kn-8; Ab-8; AR-3; GC-1, 8, 9	All teachers
SW-3	Pharmacological regulation of the functional state of excitable tissues.	Pharmacological effects on excitability and excitation. Blockers of sodium and potassium channels. Na ⁺ /K ⁺ -ATPase inhibitors, effect on membrane potential, intracellular concentration of Na ⁺ ions, cell volume, cardiomyocyte contractions. Calcium channel blockers. Methods of pharmacological blockade of neuromuscular transmission of excitation in skeletal muscle.	Kn-1-8; Ab-1-8; AR-1-3; GC-2, 4, 6-9; PC-1,3,4,6	All teachers
SW-4	Assessment of human physical development. Structural and functional organization of the musculoskeletal system.	Functions of the musculoskeletal system. Motor activity of the organism. Gross and fine motor skills. Neuro-motor units. Muscle strength and function. Optimal load. Fatigue. Human motor activity in the implementation of complex motor tasks in extreme conditions. Impact of physical activity on the functional state of skeletal muscles. Physiological bases of methods of research of physical status and health of the person.	Kn-1-8; Ab-1-8; AR-1-3; GC-2, 4, 6-9; PC-1,3,4,6	All teachers
SW-5	Pharmacological correction of functional state and tone of smooth muscle.	Features of excitation and contraction of smooth muscle in comparison with skeletal. Regulation of smooth muscle tone by the autonomic nervous system and humoral factors. The use of agonists and antagonists of different types of receptors to regulate the tone of smooth muscle fibers of blood vessels, bronchi. Pharmacological regulation of intestinal motility. Effect of prostaglandins on	Kn-1-8; Ab-1-8; AR-1-4; GC-2, 4, 6-9, 14; PC-1,3,4,6	All teachers

		smooth muscle contraction.		
SW-6	Functional significance of neurotransmitters, their classifications, cytoreceptors, pharmacological correction. Gasotransmitters (NO, H ₂ S), role in the functioning of the CNS and ANS).	CNS neurotransmitters, classifications. Receptors. NMDA- and AMPA glutamate receptors, role in long-term potentiation. Features of GABA receptors, effects of their agonists and antagonists in the correction of functional activity of the brain. Types of serotonin, dopamine, histamine, receptors in the CNS. Effects of monoamine oxidase inhibitors (MAOIs). Gasotransmitters - NO, H ₂ S, mechanisms of action, effects in the CNS and ANS.	Kn-1-8; Ab-1-8; AR-1-5; GC-2, 4, 6-9; PC-1,3,4,6	All teachers
SW-7	Maintaining of brain activity. Neuro-hormonal systems of the brain.	Ascending effect of reticular formation on brain activity. The role of cholinergic, adrenergic, dopaminergic systems of the brain. Neurosecretion. The role of neurotransmitters, hormones (oxytocin, vasopressin, etc.) in the formation of motivations, emotions, influence on memory processes and other higher nervous activities.	Kn-1-8; Ab-1-8; AR-1-5; GC-2, 4, 6-9; PC-1,3,4	All teachers
SW-8	The role of capsaicin receptors TRPV1 in thermosensitivity and TRPM8 receptors in touch (Nobel Prize in Physiology 2021) for the discovery of modern pharmacological agents.	Features of the structure of TRP family receptors. Mechanisms of activation of TRPV1 and TRPM8. Temperature limits of activation of TRPV1 and TRPM8 receptors. Winners of the Nobel Prize in Physiology or Medicine in 2021 for the discovery of channels TRPV1, TRPM8, Piezo and their role in the perception of heat, cold and touch.	Kn-1-8; Ab-1-8; AR-1-5; GC-2, 4, 6-9; PC-3,4	All teachers
SW-9	Addiction, mechanisms of formation.	Types of addictions. Stages and mechanisms of addiction formation. The role of basal ganglia, tonsils, prefrontal cortex in the formation of addiction. Neurohumoral mechanisms of addiction development. The role of opioid peptides in the balance of positive and negative emotions and imbalance in addicts.	Kn-1-8; Ab-1-8; AR-1-5; GC-1, 2, 7-9, 14; PC-1,3,4,6	All teachers
SW-10	Sleep, its types, mechanisms, biological role.	Physiology of sleep, its types and phases, electrical activity of the brain. The role of serotonergic neurons of raphe nucleus and noradrenergic neurons of the blue spot in the regulation of sleep, suprachiasmatic nucleus of the hypothalamus in the regulation of sleep. The role and mechanisms of action of melatonin. Modern mechanisms of sleep development, its biological role and disorders. Biological rhythms, their physiological role. Desynchrony (jetlag).	Kn-1-8; Ab-1-8; AR-1-5; GC-1, 2, 7-9, 14; PC-1,3,4,6	All teachers
SW-11	The role of hormones in the regulation of sexual function.	Gonads. Sexual differentiation, development and functions of the reproductive system. Puberty. Male reproductive system, its structure and functions. Spermatogenesis. Endocrine function of the testes, regulation of testicular function, the regulation by	Kn-1-8; Ab-1-8; AR-1-4; GC-2, 4, 6-9; PC-1,3,4,6	All teachers

		hypothalamic-pituitary system. Female reproductive system, its structure and functions. Ovarian hormones, their role, regulation of ovarian function. Menstrual cycle, regulation. Placental hormones. Lactation. Contraception. Age features of the gonads functions.		
SW-12	Regulatory effects of white, beige and brown adipose tissue and metabolism.	The role of white, beige and brown adipose tissue in thermogenesis. Adipose tissue hormones and their clinical significance. Metabolic effects of leptin. Influence of brown and beige adipose tissue on melatonin production. Functions of melatonin. Features of the role of brown and beige adipose tissue in early childhood and in adults.	Kn-1-8; Ab-1-8; AR-1-4; GC-2, 4, 6-9; PC-1,4	All teachers
SW-13	Pharmacological correction of the systemic activity of human body.	The role of CNS neurotransmitters in the regulation of motor activity. The concept of agonists and antagonists. Agonists and antagonists of serotonin, dopamine, glutamate, glycine receptors, adreno-, choline-, GABA-receptors. The use of dopamine precursors in the degeneration of dopaminergic neurons of the substantia nigra.	Kn-1-8; Ab-1-8; AR-1-5; GC-1-12,14; PC-1,3,4,6	All teachers
SW-14	Physiological basis of the impact of physical activity and the physiological significance of exerkin for health, the formation of body resistance and stress reactions.	What substances are called exerkin? Myokines, adipokines, organokines. Molecular and cellular targets of exerkin. The effects of exerkin. Effects of orange on the heart, skeletal muscle. The role of exerkin in the formation of body resistance and the development of stress reactions.	Kn-1-8; Ab-1-8; AR-1-5; GC-1-12,14; PC-1,3,4,6	All teachers
SW-15	Basics of rational consumption of macro- and micronutrients. The value of micronutrient deficiency to reduce the functional activity of lymphocytes and the formation of long-COVID-19.	Features of immune reactions at COVID-19 in comparison with other coronavirus infections. Changes in the number and activity of lymphocytes, in particular CD4 + -T-lymphocytes, CD8 + -T-lymphocytes, under the conditions of COVID-19 and long-COVID-19.	Kn-1-8; Ab-1-8; AR-1-5; GC-1-12,14; PC-1,3,4,6	All teachers
SW-16	Physiological reasoning for stopping bleeding with pharmacological agents. Blood depot, physiological significance.	Ways to stop bleeding. Endogenous and exogenous anticoagulants and fibrinolytics. Blood depot, physiological significance. Changes in the number of platelets in the blood during splenectomy. Blood components and preparations. Blood substitutes.	Kn-1-8; Ab-1-8; AR-1-5; GC-1-12,14; PC-1,3,4,6	All teachers
SW-17	Physiological significance of blood changes under COVID-19 conditions. Hybrid immunity, its	Receptors through which the coronavirus SARS-CoV-2 penetrates the mucous membranes of the respiratory tract and enterocytes of the small intestine. Endothelial dysfunction, changes in hemostasis, the development of immune	Kn-1-8; Ab-1-8; AR-1-5; GC-1-12,14; PC-1,3,4,6	All teachers

	importance for counteracting SARS-CoV2.	responses under COVID-19. The concept of hybrid immunity. Assessment of immunity levels in patients with SARS-CoV2. Hybrid immunity after vaccination.		
SW-18	Modern breath tests to assess the integrative activity of the body.	Informativeness, sensitivity, non-invasiveness and other benefits of using breath tests to assess the condition of the body. Physiological significance of research of respiratory tests for establishment of disturbances of functions of a gastrointestinal tract. Carbon tests: ¹³ C-urease test (for H. pylori); ¹³ C-metacetin (to assess the functional state of the liver); ¹³ C-mixed triglyceride breath test and ¹³ C-labeled-starch breath test (to assess the functional state of the pancreas; ¹³ C-octanoic acid breath test (for a comprehensive assessment of the body).	Kn-1-8; Ab-1-8; AR-1-5; GC-1-12,14; PC-1,3,4,6	All teachers
SW-19	Features of regional blood circulation	Features of blood supply to the myocardium, skeletal muscles, brain, lungs, kidneys, intestines. Receptors of smooth muscle fibers of blood vessels. Vasoconstrictors and vasodilators. Methods of assessment of regional blood circulation. Physiological bases for the use of catecholamines during a significant decrease in blood pressure; α 1-adrenoceptor blockers, calcium channel blockers under conditions of hypertension.	Kn-1-8; Ab-1-6; AR-1-4; GC-2,4,6-9,12; PC-1,3,4,6	All teachers
SW-20	Physiological features of lymphatic circulation.	Lymph, its composition, quantity, function. Mechanisms of lymph formation and movement in lymphatic vessels.	Kn-1-8; Ab-1-6; AR-1-4; GC-2,4,6-9,12; PC-1,3,4,6	All teachers
SW-21	Pharmacological correction of heart activity.	Mechanism of action and effects of M-cholinoreceptor and β -adrenoceptor blockers on heart rate. The mechanism of positive inotropic effect of cardiac glycosides - inhibitors of Na ⁺ / K ⁺ -ATPase. Effect of phosphodiesterase inhibitors on cardiac activity. Influence of adrenomimetics on heart activity.	Kn-1-8; Ab-1-6; AR-1-4; GC-2,4,6-9,12; PC-1,3,4,6	All teachers
SW-22	The role of microbiota for the creation of physiologically-based pharmacological effects on the human body.	The value of microbiota for digestion. Oral microbiota and its effect on the general condition of the human body. The composition of the microbiota of the colon. Functions of microbiota. The use of pro- and prebiotics. Prevention of dysbacteriosis caused by antibiotic therapy.	Kn-1-8; Ab-1-6; AR-1-5; GC-2,4,6-9,12; PC-1,3,4,6	All teachers
SW-23	Physiological bases of hunger and satiety.	Physiological bases of hunger and satiety. Motivation of eating behavior. The role of ghrelin and leptin in eating behavior. Changes in eating behavior when the hunger center or satiety center is activated or damaged.	Kn-1-8; Ab-1-6; AR-1-4; GC-2,4,6-9,12; PC-1,3,4	All teachers
SW-24	Regulation of water-electrolyte balance.	Mechanisms of action, effects of vasopressin, aldosterone, parathyroid hormone, natriuretic hormone. The role of	Kn-1-8; Ab-1-6; AR-1-5; GC-2,4,6-9,	All teachers

		the renin-angiotensin-aldosterone system in the regulation of ionic composition of blood plasma, circulating blood volume, blood pressure.	12; PC-1,3,4,6	
SW-25	The role of the kidney in maintaining of hematopoiesis.	Erythropoiesis, stem cell differentiation, stages, regulation of erythropoiesis. The role of erythropoietin in the regulation of erythrocyte formation. Structure, receptors, target cells, the mechanism of action of erythropoietin. Conditions under which the secretion of erythropoietin by the kidneys increases. Hormones that enhance the action of erythropoietin: testosterone, catecholamines.	Kn-1-8; Ab-1-6; AR-1-4; GC-2,4,6-9, 12; PC-1,3,4,6	All teachers
SW-26	Modern views on the development of physiologically-based "smart drugs".	Hybrid compounds enriched with NO, H ₂ S: NO-aspirin, S-aspirin, NOSH aspirin. H ₂ S-derivatives of nonsteroidal anti-inflammatory drugs (NSAIDs). Prevention of cytoaggressive effects of NSAID-COX-2 inhibitors. The meaning of "smart medicine". Prospects for the development of "smart drugs". The use of nanocarbon compounds as a system for delivering drugs, antigens, genes to cells.	Kn-1-8; Ab-1-8; AR-1-5; GC-1-12,14; PC-1,3,4,6	All teachers

Self work hours - 60

8. Verification of learning outcomes

The current control is carried out at each practical class according to the thematic plan in order to check the assimilation of students' learning material. Forms of assessment of current educational activities are standardized and include control of theoretical and practical training.

The following methods of the level of students' knowledge assessment are used: testing, situational problems solving, interpretation and evaluation of laboratory tests and their results, practical skills evaluation.

Learning outcome code	Code of the classes' type	Verification of results	Criteria
Kn-1-8; Ab-1-8; AR-1,2,4; GC-2,4,6-9,14; PC-1,3,4,6	L-1, P-1-3, SW-1-5	At the beginning of practical lesson test control is carried out: tests contain 10 multiple choice questions with one correct answer. At the main stage of the practical lesson, the practical work (research), the research protocol in accordance with the requirements, the ability to analyze and interpret research results and make conclusions are assessed. Control of theoretical and practical preparation on the last stage of practical lesson is carried out by solution of clinical cases which allow evaluate the degree of achievement of educational purpose.	Assessment of mastering each topic for the current educational activities of the student is carried out on a 4-point (national) system. It takes into account all types of activities provided for by the program of the discipline. A student must receive a grade for each topic: Grade excellent «5» – student answers not less than 90% educational tasks correctly; Grade good «4» – student answers not less than 80% educational tasks correctly; Grade satisfactory «3» – not less than 60% educational tasks correctly; Grade unsatisfactory «2» – student answers less than 60% educational tasks.
Kn-1-6, 8; Ab-1-8; AR-1-5; GC-2,4,6-9,14; PC-1,3,4,6	L-2, 3, P-4-6, SW-6, 7		
Kn-1-8; Ab-1-8; AR-1-5; GC-2, 4, 6-9; PC-3,4,6	P-7, SW-8		
Kn-1-8; Ab-1-8; AR-1-5; GC-2,4,6-9,14; PC-1,3,4,6	P-8, SW-9, 10		
Kn-1-6, 8; Ab-1-6; AR-1-4; GC-1-12,14; PC-1,3,4,6	L-3, P-9, 10, SW-11-15		
Kn-1-8; Ab-1-8; AR-1-5; GC-2,4, 6-9; PC-1,3,4,6	L-4, P-11, SW-16, 17		
Kn-1- 8; Ab-1-6,8; AR-1-4; GC-1-12,14; PC-1,3,4,6	L-5, P-12, SW-18		
Kn-1-8; Ab-1-8; AR-1-5; GC-2,4,6-9,12; PC-1,3,4,6	L-6, P-13, 14, SW-19- 21		
Kn-1- 8; Ab-1-6,8; AR-1-5; GC-1-12, 14; PC-1,3,4,6	L-7, P-15, 16, SW-22- 26		

Final control

General evaluation system	Participation in the current educational activity during the semester / exam – 60% / 40% on a 200-point scale
Evaluation scales	traditional 4-point scale, multi-point (200-point) scale, ECTS rating scale
Conditions for admission to the final control	The student attended all practical (laboratory, seminar) classes and gained at least 72 points for current educational activity

Type of final control	Methods of final control	Criteria
Exam	The exam is conducted in the format of an online exam on the misa platform. The control of the student's preparation during the online exam on the misa platform, which lasts 120 minutes, is carried out according to the following regulations: organizational work - 15 minutes, computer test control (90 minutes to solve 80 test tasks). Export, visualization, analysis and results (15 minutes).	Exam tasks are checked automatically online using the misa software. The highest possible score points which a student can get for exam is 80. The minimum number of point required for exam enrollment is 50.
Exam evaluation criteria		
Exam	The final exam is carried out after the completion of the discipline according to the approved schedule. Final control consists of the following stages: 1. 40 multiple choice questions with one correct answer, 2. 40 extended multiple choice questions. The maximal number of points, which student can collect as a result of final exam – 80 (40 points for the tasks with one correct answer – 1 point, and 40 points for the correct answers for the extended test tasks), the minimal number of points – 50 (the sum of points for the correct answers to the questions with one correct answer and for correct answers to test tasks of extended content). It is considered unsatisfactory score of 49 or less points ($\leq 61.9\%$). Correct answer to one task in the format of one correct answer - 1 point. Correct answer to one task of extended content (with 2 correct answers) - 1 point if the student chose 2 of 2 correct answers; 0.5 points if the student chose 1 of 2 correct answers; 0 point if the student chose additionally the wrong answer).	The complex number of points that student earns on average (for two parts of the exam) in% is converted into points on the results: 80 points – all answers are correct for 100%, 79 points – 98.75% 78 points – 97.50% 77 points – 96.25% 76 points – 95% 75 points – 93.75% 74 points – 92.50% 73 points – 91.25% 72 points – 90% 71 points – 88.75% 70 points – 87.50% 69 points – 86.25% 68 points – 85% 67 points – 83.75% 66 points – 82.50% 65 points – 81.25% 64 points – 80% 63 points – 78.75% 62 points – 77.50% 61 points – 76.25% 60 points – 75% 59 points – 73.75% 58 points – 72.50% 57 points – 71.25% 56 points – 70% 55 points – 68.75% 54 points – 67.50% 53 points – 66.25% 52 points – 65% 51 points – 63.75% 50 points – 62% - 62.50% 40 points – 50%, 30 points – 37.50% 20 points – 25% 15 points – 18.75%; 10 points – 12.50% 0 points – if the student does not choose any correct answer or scored less than 12.50%
Maximal number of score points which a student can collect for the current educational activity to the exam admission is 120 points.		
Minimal number of score points which a student can collect for the current educational activity to the exam admission is 72 points.		
The calculation of the points number is based on the student's score on a 4-point (national) scale during the study of the discipline, by calculating the arithmetic mean (AM) rounded to two decimal places. The resulting value is converted into points by multi-points scale as follows: $x = AM \times 120 / 5$		
9. Course policy		
<ol style="list-style-type: none"> 1. Provides teamwork aimed at the useful result of acquiring knowledge and skills. 2. Communication in the audience is friendly, collegial, open to constructive discussion and scientific dialogue. 3. Practical classes are conducted according to the plan and schedule. 4. Adherence to the rules of academic integrity. 5. Students' reports must be made in person and present prepared material in a scientific style. 6. Practical tasks should be conducted with using the achievements of medical science and clinical parallels with the topic of classes. 		
10. Literature		
Required: <ol style="list-style-type: none"> 1. Guyton and Hall Textbook of Medical Physiology (Guyton Physiology) (2020), 14th Edition. Elsevier. 2. Widmaier E., Hershel Raff H., Strang K. Vander's Human Physiology (2018), 15th Edition McGraw Hill Education, New York. 3. Physiology. Edited by V.M. Moroz, O.A. Shandra - 2th ed. Nova Knyga. - 2016. – 728 p. 4. First aid for the USMLE Step 1 2018. A student-to-student guide / T. Le, V. Bhushan, M. Sochat, K. Kallianos, 		

- Y. Chavda, A.Zureick, M.Kalani. McGraw Hill Education, 2018, 816 p.
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 6. Savytska M.Ya., Kupynyak N.I. Physiology of excitable tissues. Methodical instructions for practical lessons for students of medical faculty. / Ed. O.S. Zayachkivska. - Danylo Halytskyi Lviv National Medical University, 2017. – P. 40.
 7. Kupynyak N.I., Savytska M.Ya. Physiology of sensory system. Methodical instructions for practical lessons for students of medical faculty. / Ed. O.S. Zayachkivska. - Danylo Halytsky Lviv National Medical University, 2017. – P. 50.
 8. Savytska M.Ya., Kupynyak N.I., Pshyk-Titko I.O. Physiology of central nervous system. Methodical instructions for practical lessons for students of medical faculty. / Ed. O.S. Zayachkivska. - Danylo Halytsky Lviv National Medical University, 2017. – P. 38.
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 11. Kupynyak N.I., Savytska M.Ya. Physiology of the respiratory system. Handbook for practical lessons for students of medical faculty. / Ed. O.S. Zayachkivska. – Danylo Halytsky Lviv National Medical University, 2017. – P. 57.
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 13. Kovalchuk I.M., Kupynyak N.I., Savytska M.Ya. Physiology of cardiovascular system. Handbook for practical lessons for students of the Medical Faculty / Ed. O.S. Zayachkivska.- Danylo Halytsky Lviv National Medical University, 2017. – 82 p.
 14. Bezpalko L.Yu., Savytska M.Ya, Kupynyak N.I. Physiology of digestive system. Handbook for practical classes for students of the medical faculty. / Ed. O.S. Zayachkivska. - Danylo Halytsky Lviv National Medical University, 2017. – P. 72.
 15. Pohoretska Ya.O., Kupynyak N.I., Savytska M.Ya. Renal Physiology. Methodical instructions for practical lessons for students of medical faculty. / Ed. O.S. Zayachkivska. - Danylo Halytsky Lviv National Medical University, 2017. – 32 p.
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Additional

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Information resources

1. <http://biph.kiev.ua/uk/UPhSNews>
2. <http://www.physiologyinfo.org/mm/What-is-Physiology>
3. <http://www.medicalnewstoday.com/articles/248791.php>
4. <http://www.physoc.org/>
5. <http://medtropolis.com/your-health/>
6. <http://www.physiologyweb.com/>
7. <http://www.teachpe.com/anatomy/>

RECOOPGate

1. <https://www.cedars-sinai.org/research/administration/recoop/areas.html>
2. Lifestyle, Obesity, Diabetes and Cardiovascular Disease
https://drive.google.com/drive/folders/1uw_0rq-QBVFaaSeievzxKAnF-FwCYn1P
3. Life Style and Physical inactivity
https://drive.google.com/drive/folders/1bHnt4Au9TbWLbKEp_2KBxKJhlt_B3IJC

11. Equipment, logistical and software support of the discipline / course

1. Neurological hammers - 7 pcs;
2. Goryaev chamber - 5 pcs;
3. Sally hemometer - 2 pcs;
4. Sivtsev tables - 7 pcs;
5. Landolt circles - 2 pcs;
6. Rabkin tables - 2pcs;
7. Surgical scissors -10 pcs;
8. Express predictor pregnancy tests - 40 pcs;
9. THC urine test - 15 pcs;
10. Ketones urine test - 1 pc;
11. Glucose urine test - 1 pc;
12. Anti-A serum - 1 bottle;
13. Anti-B serum - 1 bottle;
14. Anti-D serum - 1 bottle;
15. Hydrometer - 3 pcs;
16. Pulse oximeter - 1 pc;
17. Portable spirometer - 1pc;
18. ECG complex - 1 pc;
19. Rheographic digital complex - 1 pc;
20. Tonometers - 7 pcs;
21. Medical weight scales - 2 pcs;
22. Height scales - 2 pcs;
23. Dynamometer - 5 pcs;
24. Microscope Erudit - 3 pcs;
25. Light microscope with WEB camera and Ulab electric illumination;
26. Training model of the brain 1 pc;
27. Electronic micropipette - 2 pcs;

28. Centrifuge - 2 pcs;
29. Analogical models for research of excitable tissues, CNS, sensory systems, higher nervous functions;
30. Analogical models for functional studies by exercise tolerance test (cycle ergometer, heart rate variability, saliva microcrystallization, etc.);
31. Smart TV;
32. Collection of educational videos;
33. Multimedia projectors;
34. MISA Moodle for computerized testing online 2018;
35. IFOM. Software, 2018;
36. Tabular fund;
37. Training models of the skull and internal organs;
38. Training schemes of functional systems and molecular mechanisms of realization of functions in a human body.

12. Additional information

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<https://new.meduniv.lviv.ua/en/kafedry/kafedra-normalnoyi-fiziologiyi/>

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