

MINISTRY OF HEALTH OF UKRAINE  
HIGHER STATE EDUCATIONAL ESTABLISHMENT OF UKRAINE  
«BUKOVINIAN STATE MEDICAL UNIVERSITY»

"APPROVE"

Vice-rector for scientific and pedagogical work  
Associate Professor I.V. Gerush  
"25" 08/2020

STUDENT GUIDE  
(SYLLABUS)  
of studying the discipline

"HUMAN ANATOMY AND PHYSIOLOGY"

Field of knowledge 22 Healthcare  
(code and name of the field of knowledge)

Specialty 226 Pharmacy, industrial pharmacy  
(code and name of the specialty)

Educational degree master  
(master, bachelor, junior bachelor)

Educational year 1 (2)

Form of study full-time  
(full-time, part-time, distance)

Department Department of physiology named after Ya.D. Kirshenblat  
(name of the department)

Approved at the methodical session of the department of physiology named after Ya.D. Kirshenblat  
"27" May 2020 (Protocol № 16).

Head of the Department \_\_\_\_\_ (Tkachuk S.S.)  
(signature)

Approved by the subject methodical commission on medical and biological disciplines of physiological and physicochemical profile  
"18" June 2020 (Protocol № 11).

Chairman of the subject methodical commission \_\_\_\_\_ (Tkachuk S.S.)  
(signature)

Chernivtsi – 2020

## GENERAL INFORMATION ABOUT SCIENTIFIC AND PEDAGOGICAL WORKERS WHO TEACH THE SUBJECT

<b>Department</b>	Department of physiology named after Ya.D. Kirshenblat
<b>Surname, name of scientific and pedagogical staff, scientific degree, academic status</b>	Yasinska Olena Viktorivna - Associate Professor of Department of physiology named after Ya.D. Kirshenblat, PHD of Medical Sciences, Associate Professor <a href="mailto:jasinska.olena@bsmu.edu.ua">jasinska.olena@bsmu.edu.ua</a> Bukataru Yuliana Serhiivna - Assistant of Department of physiology named after Ya.D. Kirshenblat, PHD of Pharmaceutical Sciences <a href="mailto:yuliana.bukataru@bsmu.edu.ua">yuliana.bukataru@bsmu.edu.ua</a>
<b>Web page of the department on the official website of the university</b>	<a href="https://www.bsmu.edu.ua/fiziologiyi-im-ya-d-kirshenblata/">https://www.bsmu.edu.ua/fiziologiyi-im-ya-d-kirshenblata/</a>
<b>Department website</b>	<a href="http://physiology.bsmu.edu.ua/">http://physiology.bsmu.edu.ua/</a>
<b>E-mail</b>	<a href="mailto:physiology@bsmu.edu.ua">physiology@bsmu.edu.ua</a>
<b>Address</b>	Chernivtsi, Bogomolets Street, 2
<b>Contact phone</b>	+38 (0372) 52-67-29

### 1. GENERAL INFORMATION ABOUT THE DISCIPLINE

<b>Status of the discipline</b>	normative
<b>Number of credits</b>	5
<b>Total amount of hours</b>	150
<b>Lectures</b>	30
<b>Practical lessons</b>	70
<b>Individual work</b>	50
<b>Type of final control</b>	final module control

### 2. DESCRIPTION OF THE DISCIPLINE (ABSTRACT)

Human anatomy and physiology as an academic discipline provides pharmacists with a significant amount of theoretical knowledge and practical skills on the structural and functional organization of the organism at different levels, mechanisms and patterns of regulation of functions as a basis for sound use of pharmacological agents.

### 3. POLICY OF THE SUBJECT

#### 3.1. List of normative documents:

- Regulations on the organization of the educational process (<https://www.bsmu.edu.ua/wp-content/uploads/2020/03/polozhennya-pro-organizacziyu-osvitnogo-proczesu-u-vdnzu-bukovinskij-derzhavnij-medichnij-universitet.pdf>);
- Instructions for assessing the educational activities of BSMU students in the implementation of the European credit transfer system of the educational process (<https://www.bsmu.edu.ua/wp-content/uploads/2020/03/bdmu-instrukcziya-shhodo-oczinyuvannya-%D1%94kts-2014-3.pdf>);
- Regulations on the procedure for reworking missed and uncredited classes (<https://www.bsmu.edu.ua/wp-content/uploads/2019/12/reworks.pdf>);
- Regulations on the appeal of the results of the final control of knowledge of higher education (<https://www.bsmu.edu.ua/wp-content/uploads/2020/07/polozhennya-pro-apelyacziyu-rezultativ-pidsumkovogo-kontrolyu-znan.pdf>);
- Codex of Academic Integrity ([https://www.bsmu.edu.ua/wp-content/uploads/2019/12/kodeks\\_academic\\_faith.pdf](https://www.bsmu.edu.ua/wp-content/uploads/2019/12/kodeks_academic_faith.pdf));
- Moral and ethical codex of students ([https://www.bsmu.edu.ua/wp-content/uploads/2019/12/ethics\\_code.docx](https://www.bsmu.edu.ua/wp-content/uploads/2019/12/ethics_code.docx));

- Regulations on the prevention and detection of academic plagiarism (<https://www.bsmu.edu.ua/wp-content/uploads/2019/12/antiplagiat-1.pdf>);
- Regulations on the procedure and conditions for students to choose elective courses ([https://www.bsmu.edu.ua/wp-content/uploads/2020/04/nakaz\\_polozhennyz\\_vybirkovi\\_dyscypliny\\_2020.pdf](https://www.bsmu.edu.ua/wp-content/uploads/2020/04/nakaz_polozhennyz_vybirkovi_dyscypliny_2020.pdf));
- Rules of internal labor regulations of the Higher State Educational Institution of Ukraine "Bucovynian State Medical University" (<https://www.bsmu.edu.ua/wp-content/uploads/2020/03/17.1-bdmu-kolektivnij-dogovir-dodatok.doc>).

**3.2. Policy on adherence to the principles of academic integrity of higher education students:**

- independent performance of educational tasks of current and final controls without the use of external sources of information;
- cheating during control of knowledge is prohibited;
- independent performance of individual tasks and correct registration of references to sources of information in case of borrowing of ideas, statements, information.

**3.3. Policy on adherence to the principles and norms of ethics and deontology by higher education students:**

- actions in professional and educational situations from the standpoint of academic integrity and professional ethics and deontology;
- compliance with the rules of internal regulations of the university, to be tolerant, friendly and balanced in communication with students and teachers, medical staff of health care institutions;
- awareness of the importance of examples of human behavior in accordance with the norms of academic integrity and medical ethics.

**3.4. Attendance policy for higher education students:**

- attendance at all training sessions (lectures, practical (seminar) classes, final modular control) is mandatory for the purpose of current and final assessment of knowledge (except for respectable reasons).

**3.5. Deadline policy and completion of missed or uncredited classes by higher education students:**

- reworks of missed classes are held according to the schedule of missed or uncredited classes and consultations.

**4. PRECISIONS AND POST-REQUIREMENTS OF THE EDUCATIONAL DISCIPLINE (INTERDISCIPLINARY RELATIONS)**

List of disciplines, on which the study of academic discipline is based	List of academic disciplines, for which the basis is laid as a result of studying the discipline
Biology with the basics of genetics	Pathological physiology
Ethics and deontology in pharmacy	Microbiology with the basics of immunology
Biological physics with physical methods of analysis	First aid with introductory medical practice
Latin	Pharmacology
Philosophy	Pharmacognosy
Higher mathematics and statistics	Pharmaceutical chemistry
	Biological chemistry
	Clinical pharmacy and pharmaceutical care
	Toxicological and forensic chemistry
	Medical toxicology
	Biopharmacy

**5. PURPOSE AND TASKS OF THE EDUCATIONAL DISCIPLINE:**

5.1. The purpose of teaching the discipline "Human Anatomy and Physiology" is to provide pharmacists with a significant amount of theoretical knowledge and practical skills on structural and functional organization of the body at different levels, mechanisms and patterns of regulation of functions as a basis for sound use of pharmacological agents.

5.2. The main tasks of studying the discipline are:

- formulate conclusions about the structure of the organism and its parts;
- formulate conclusions about the state of physiological functions of the organism, its systems and organs;
- know the age features of the structure and functions of the organism and their regulation;
- analyze human anthropometric parameters, their impact on health;
- analyze the state of human health on the basis of physiological parameters;
- interpret the mechanisms and patterns of functioning of excitable structures;
- explain the importance of sensory processes in human life;
- analyze the mechanisms of integrative activity of the organism;
- analyze the functional parameters of the organism and explain the possibilities of their pharmacological correction in the desired direction;
- taking into account the anamnesis and clinical and laboratory examination of the patient to determine the physiological factors that affect the processes of absorption, metabolism and excretion of the drug.

## **6. COMPETENCIES, THE FORMATION OF WHICH IS CONTRIBUTED BY THE DISCIPLINE:**

### **6.1. Integral competence:**

Ability to solve typical and complex specialized problems and critically comprehend and solve practical problems in professional pharmaceutical and / or research and innovation activities using the provisions, theories and methods of basic, chemical, technological, biomedical and socio-economic sciences; integrate knowledge and solve complex issues, formulate judgments on insufficient or limited information; clearly and unambiguously convey their own knowledge, conclusions and their validity to professional and non-professional audience.

### **6.2. General competencies:**

**GC 2.** Ability to apply knowledge in practice.- Ability to apply knowledge in practical situations.

**GC 3.** The desire to preserve the environment.- Apply knowledge of general and professional disciplines in professional activities.

**GC 4.** Ability for abstract thinking, analysis and synthesis, to learn and be modernly trained.

**GC 6.** Knowledge and understanding of the subject area and understanding of professional activity.

**GC 12.** Ability to conduct research at the appropriate level.

### **7.3. Professional competencies of the specialty:**

**PC 18.** Ability to ensure the rational use of prescription and over-the-counter drugs in accordance with the physicochemical, pharmacological characteristics, biochemical, pathophysiological features of a particular disease and pharmacotherapeutic regimens for its treatment.

**PC 20.** Ability to provide counseling and pharmaceutical care when selecting and dispensing over-the-counter drugs by assessing the risk / benefit, compatibility, indications and contraindications based on the patient's health status, taking into account biopharmaceutical, pharmacokinetic, pharmacodynamic and physicochemical characteristics.

## **7. RESULTS OF STUDYING THE DISCIPLINE.**

As a result of studying the discipline student must:

### **7.1. Know:**

- the structure of the human body, organs and systems that make it up;
- the course of physiological functions of the organism, its systems and organs;
- how at the functional level of all life support systems of the human body, to understand the types of regulation in the work of all fundamental systems and their interaction;
- mechanisms and patterns of functioning of excitable structures;
- mechanisms of regulation of body functions of its systems and organs;
- age features of the structure and functions of the organism and their regulation;
- methods of studying the parameters of the structure and function of the organism;
- normal values of the parameters of the body.

### **7.2. Be able to:**

- Analyze information about the structure of the human body, its constituent systems, organs and tissues
- To determine the topographic and anatomical relationships of human organs and systems
- Interpret gender, age and individual characteristics of the human body

- To predict the interdependence and unity of structures and functions of human organs and their variability under the influence of environmental factors
- To determine the impact of social conditions and labor on the development and structure of the human body
- Analyze the age characteristics of body functions and their regulation
- Analyze the regulated parameters and draw conclusions about the mechanisms of nervous and humoral regulation of physiological functions of the organism and its systems
- Analyze the state of human health under different conditions on the basis of physiological criteria
- To analyze the state of sensory processes in ensuring human life

### 8.3. Demonstrate:

- possession of moral and ethical principles of attitude to a living person and his body as an object of anatomical and clinical research
- the ability to explain the physiological basis of methods for studying the functions of the body
- the ability to explain the mechanisms of integrative activity of the organism
- the ability to analyze the functional parameters of the organism and explain the possibilities of their pharmacological correction in the desired direction
- the ability to formulate a conclusion about the state of physiological functions of the organism, its systems and organs
- the ability to interpret the mechanisms and patterns of functioning of excitable structures of the body

## 8. INFORMATIONAL SCOPE OF THE DISCIPLINE

### *Description of each module of the discipline:*

The study discipline is given 150 hours (5 ECTS credits) - 2 modules "Human Anatomy and Physiology", which consist of 6 content modules.

### 8.1. Specific objectives of the module (content modules).

#### **Module 1. Anatomy and physiology of the musculoskeletal system and regulatory systems**

##### *Content modules:*

#### **Content module 1. Introduction to human anatomy and physiology. Structure and functions of musculoskeletal structures.**

##### *Specific goals:*

- Understand the principles of structural and functional organization of the human body.
- Explain the morphological and physiological basis of methods for studying the structure and functions of the organism.
  - Analyze the stages of formation of human anatomy and physiology, their place in the system of higher pharmaceutical education.
  - Interpret the concept of "functional system" of the body and the importance of regulatory mechanisms to achieve an adaptive response - maintaining health.
  - Analyze the dependence of the shape and structure of bones on their function.
  - Analyze the structural and functional features of the development of bones and their joints and the mechanisms of influence of chemical and other factors on them.
  - Understand the mechanisms of origin of resting potential and action potential in excitable structures.
    - Interpret the effect of different parameters of electrical impulses on nerve and muscle fibers.
    - Draw conclusions about excitability based on the magnitude of the stimulus.
    - Explain the mechanisms of nerve impulse conduction, interpret the causes of their violation.
    - Explain the mechanisms of chemical transmission of excitation and the possibility of its correction by pharmacological agents.
    - Interpret the mechanisms of blockade and fatigue of the neuromuscular synapse.
    - Know the structure of muscles and their structural features depending on the function.
    - Explain the dependence of the nature of muscle contraction on the strength and frequency of stimulation.
      - Know the factors that affect the strength of muscle contraction and the speed of the nerve impulse.

- Interpret the synapse as an object of exposure to drugs, poisons and toxins.

## **Content module 2. Structure and functions of regulatory systems of the organism.**

### ***Specific goals:***

- Interpret the basic principles and mechanisms of regulation of physiological functions of the body.
  - Analyze the structural and functional organization of the nervous system and its role in the regulation of human body functions.
    - Explain the mechanisms of information transfer to the CNS and the role of neurotransmitters and neuromodulators in this process.
    - Explain the mechanism of functioning of the reflex arc.
    - Explain the mechanisms of interaction of excitation and inhibition in the CNS.
  - Analyze the principles of coordination of nerve centers in ensuring the body's adaptive responses.
    - Analyze the role of different levels of the CNS in ensuring the motor functions of the body.
    - Explain the mechanisms of the autonomic nervous system on the visceral functions of the body.
    - Analyze changes in the functional state of the body when activating the sympathetic or parasympathetic nervous system.
      - Interpret the mechanisms of changes in visceral functions due to blockade of information transmission in the synapses of the autonomic nervous system by pharmacological agents.
    - Analyze the structural and functional parameters of the endocrine glands and draw conclusions about the mechanisms of their regulation.
      - To draw conclusions about the state of physiological functions of the organism, its systems in case of changes in the functional activity of the endocrine glands.
      - To draw conclusions about the state of mechanisms of regulation of physical, mental and sexual development of the body with the participation of hormones.
    - Analyze the state of mechanisms for regulating the stability of the internal environment with the participation of hormones.
      - Explain the mechanisms of nonspecific adaptation of the organism with the participation of hormones.
    - Analyze the physiological mechanisms of the possibility of using hormonal drugs as drugs.
    - Analyze the structure and functions of the human reproductive system, their role in reproduction and endocrine regulation of functions.

## **Content module 3. Anatomy and physiology of sensory systems. Higher integrative functions**

### ***Specific goals:***

- Analyze the structure and functional state of sensor systems, their structural elements.
- Interpret the functions of information transmission channels based on the analysis of functional parameters.
  - Explain the anatomical and physiological basis of methods for studying the functional state of sensory systems.
  - Explain the anatomical and physiological basis for the correction of violations of the functional parameters of sensory systems.
    - Explain the mechanisms of integrative activity based on the analysis of the role of different structures of the new cerebral cortex.
    - Explain the mechanisms of integrative activity of the new cerebral cortex in the formation of language in humans.
  - Explain the physiological basis of research methods for the types of GNI and the human nervous system.
    - Explain the mechanisms of integrative activity of the brain, which determine: language, will, attention, memory, consciousness, thinking, sleep.
    - Explain the impact of bad habits and pharmacological agents on human GNI.
    - Explain the physiological basis of research methods of higher nervous activity.
    - Explain the mechanisms of biological needs and motivation and their role in the formation of innate and acquired behaviors.

- Explain the mechanisms of emotion formation, their role in the body's behavioral reactions.

## **Module 2. Anatomy and physiology of visceral systems.**

### **Content modules:**

#### **Content module 4. Anatomy and physiology of the blood, circulatory and respiratory systems.**

##### **Specific goals:**

- Explain the concepts: blood system, homeostasis, acid-base balance, osmotic and oncotic pressure, qualitative and quantitative composition of plasma and blood cells.
  - Analyze the structural and functional features of individual components of the blood system, including hematopoietic organs.
  - Interpret the physiological functions of the blood system: transport, protective, homeostatic, respiratory.
  - Explain the physiological mechanisms of fluid maintenance and the development of hemostasis due to vascular damage.

- Make conclusions about the state of physiological functions based on the assessment of blood parameters (hematocrit, erythrocyte count, hemoglobin, leukocytes, platelets, color index, ESR, blood clotting time and duration of bleeding).

Analyze the effects of pharmacological compounds on the qualitative and quantitative indicators of blood.

- Explain the physiological basis of methods for studying the parameters of the blood system: the number of formed elements, hemoglobin, ESR, osmotic resistance of erythrocytes, duration of bleeding, blood clotting time, determination of blood groups in OR and CDE systems, determination of rhesus factor.

- Analyze the structure of the circulatory system, its structural and functional organization.
- Interpret the anatomical and physiological properties of the heart (structure and functions of the chambers and valves of the heart, automation, excitability, conductivity).
- Analyze the regulation of cardiac parameters.
- Analyze the main parameters of blood circulation and mechanisms of their regulation, the importance of the structure of blood vessels in terms of their function.
- Analyze the state of blood circulation and mechanisms of its regulation in humans during functional tests and exercise.
- Explain the physiological basis of methods of studying the circulatory system (determination of blood pressure, pulse, ECG recording, FCG, sphygmography).
- Explain the physiological basis of drug correction of functional parameters of the circulatory system.

- To draw conclusions about the state of each stage of the respiratory process based on the analysis of parameters that characterize external respiration.

- Analyze the role of chest bones and muscles, upper respiratory tract and bronchopulmonary structures in respiration.

- To draw conclusions about the effectiveness of regulation of respiratory processes on the basis of analysis of indicators of external respiration at rest, during exercise and on the basis of tests with respiratory arrest.

- Analyze the parameters that characterize the state of gas exchange and draw conclusions about the mechanisms of regulation of respiratory processes in humans under different conditions.

- Explain the physiological basis of spirometry, spirometry, pneumotachometry.
- Analyze changes in respiratory parameters due to the action of pharmacological agents.

#### **Content module 5. Anatomy and physiology of the digestive system. Energy metabolism.**

##### **Thermoregulation.**

##### **Specific goals:**

- Interpret the concept of the digestive system in terms of structure and function and mechanisms of regulation of secretory, motor and absorption function.
- Analyze the significance of the structure of individual parts of the digestive system in terms of their functions.

- To draw conclusions about the role of taste and olfactory sensory systems in determining the suitability of food for consumption.
- Assess the state of the digestive system based on the analysis of the parameters of hydrolysis of nutrients.
- To draw conclusions about the state of digestive processes in different parts of the digestive tract on the basis of analysis of secretory, motor, absorption function.
- Explain the physiological basis of modern methods of studying the functional parameters of the digestive tract.
- Explain the mechanisms of formation of hunger and satiety based on the analysis of the content of essential products of metabolism in the blood.
- Explain the mechanisms of modeling the functional state of the digestive tract using pharmacological agents.
- Draw conclusions about the intensity of metabolism based on the analysis of energy costs that characterize the basic metabolism.
- Make conclusions about the type of energy substrate based on the analysis of the respiratory rate.
- To draw conclusions about the intensity of metabolism based on the analysis of the amount of basic human metabolism.
- Interpret the concepts of "valid" and "proper" basic exchange.
- Explain the physiological basis of direct and indirect calorimetry methods.
- Analyze body temperature and draw conclusions about the regulation of the balance between heat generation and heat transfer.
- Analyze the state of thermoregulation in humans under different conditions and the possibility of its correction by drugs.

#### **Content module 6. Anatomy and physiology of the excretory system.**

##### ***Specific goals:***

- Analyze the importance of macro- and microstructure of kidneys and urinary organs to ensure urination and urination.
- To draw conclusions about the state of the processes underlying the formation of urine in the kidneys based on the analysis of the rate of filtration, secretion and reabsorption of substances and water in different parts of the nephron.
- Analyze the state of the excretory system in humans on the basis of quantitative and qualitative analysis of urine depending on food and drink.
- Analyze the parameters of homeostasis and draw conclusions about the mechanisms of their regulation with the participation of the kidneys.
- Explain the physiological basis of methods for the study of excretory function of the kidneys.
- Explain the possibility of regulation of renal excretory function by the action of certain pharmacological compounds.

#### 8.2. Thematic structure of the module (content modules).

##### **Module 1. Anatomy and physiology of the musculoskeletal system and regulatory systems.**

##### **Content module 1. Introduction to human anatomy and physiology. Structure and functions of musculoskeletal structures.**

**Topic 1. Anatomy and physiology as a science of the structure and function of the human body. Research methods in anatomy and physiology. Fundamentals of physiological experiment. The concept of structural and functional organization of the human body.** Anatomy as a science of the structure of organs and systems of the human body. The body, the elements that make it up. Levels of structural and functional organization of the human body. The concept of tissues, organs, systems, the principles of their structural and functional interaction in ensuring the normal flow of functions. The unity of the organism and the external environment. Physiology as a science of the mechanisms of life of a healthy person, the functions of the body, ways to maintain health and efficiency. The importance of physiology in the training of a pharmacist. Methods of physiological research: observation, experiment, modeling.



Physiological characteristics of functions, their parameters. The relationship between structure and function. Mechanisms of regulation of functions: nervous, humoral, self-regulation. Homeostasis, homeokinesis.

**Topic 2. The general structure of the cell. Types of cells and tissues. Structure and functions of the cell membrane. Characteristics of excitable tissues.**

The structure of the cell, its main components. The concept of body tissues, types of tissues and cells that make them up. The structure of the cell membrane. Types of transport of substances across cell membranes. Cellular channels and pumps. Excitable tissues: nervous, muscular, glandular. Structural and functional features of excitable tissues. Characteristics of excitable tissues. Irritability. Excitability. Modern idea of the nature of excitation.

**Topic 3. Bioelectrical phenomena in excitable tissues. Physiological properties of nerve fibers. Laws of excitation. Physiology of synapses.**

Membrane potential, its origin. Action potential, phase and its origin. The concept of depolarization, repolarization. Hyperpolarization. Specific and nonspecific manifestations of excitation. Change of membrane excitability during excitation, refractoriness (absolute, relative). Excitability parameters (threshold of strength. Rheobase, useful time, chronaxy, lability). Ways to regulate the functional state of excitable structures by drugs.

Structural and functional characteristics of nerve fibers. Mechanisms of nerve impulse conduction through non-myelin and myelin nerve fibers. Laws of excitation on nerve fibers. Ways of pharmacological regulation of nerve excitation (conductive blockade)

Physiology of synapses. Classification of synapses. The general structure of the chemical synapse. Study of the conduction of excitation through the synapse on the example of neuromuscular junction and transmission disorders under the action of muscle relaxants.

**Topic 4. The mechanism of muscle contraction. Types and modes of muscle contractions. Muscle strength and function.**

Physiological properties of skeletal muscles. Modern theory of muscle contraction and relaxation. Forms and types of muscle contractions. Single reduction, its phases. Summation of muscle contractions, types. Muscle strength and function. Motor unit. Optimal load. Fatigue.

Structural and functional features of unstriated muscles. Ways of pharmacological regulation of the functional state of unstriated muscles.

**Topic 5. Anatomy of the musculoskeletal system. Types of bones and their joints. The structure of the skeleton. Anatomy of the bones and joints of the torso and limbs. General data on the structure and connection of skull bones.**

The concept of musculoskeletal system, its functions. General data about the skeletal system. Bone as an organ, chemical composition and internal structure of bone. Classification of bones. Types of bone joints, their functional significance. Structure and function of torso bones and their joints. The structure and function of the bones of the upper limb and their joints. The structure and function of the bones of the lower extremity and their joints. Skull bones and their joints. Functions of the bones of the brain and facial skull.

**Topic 6. Muscular system. The structure and function of the muscles of the torso, upper and lower extremities. The structure and function of the muscles of the head and neck.**

The concept of muscle as an organ. Structural and functional classification of muscles. Auxiliary muscle apparatus. The concept of skeletal muscle, their general function. The structure and function of the muscles of the head and neck. The structure and function of the muscles of the torso. The structure and function of the muscles of the upper extremities. The structure and function of the muscles of the lower extremities.

**Content module 2. Structure and functions of regulatory systems of the organism.**

**Topic 7. General anatomy and physiology of the central and peripheral nervous system. Reflex arc analysis. Reflex time. Excitation and inhibition processes in the CNS.**

Structural and functional organization of the nervous system. A neuron is a structural and functional unit of the CNS. Reflex activity of the CNS. Reflex, see. Reflex arc. Determining the dependence of the reflex on the receptive field. Detection of the absence of reflex in the destruction of various parts of the reflex arc. Study of knee and Achilles reflexes in humans.

Reflex time. Turkic reflex time study. Determining the dependence of reflex time on the strength of the stimulus. Determination of the knee reflex time in humans using a reflexometer developed by GI Khodorovsky.

Nerve center, properties (rapid fatigue, unilateral excitation conduction, excitation irradiation, excitation rhythm transformation, excitation conduction delay, excitation summation, aftereffect, tone, high sensitivity to certain chemical compounds). The role of the CNS in the integrative and adaptive activity of the organism.

Inhibition in the CNS as an active process and one of the forms of response to stimuli. Types of inhibition: presynaptic, postsynaptic, the mechanism of their occurrence. Interaction between the processes of excitation and inhibition, their correction with the help of pharmacological agents.

#### **Topic 8. Structure and functions of the spinal cord. Spinal nerves, their functions.**

Structural organization of the spinal cord. Structural and functional features of gray and white matter of the spinal cord. Conductive function of the spinal cord. The roots of the spinal cord, the law of Bella Majandi. Spinal nerves and their plexuses, areas of innervation. The role of spinal reflexes in the regulation of functions. Motor reflexes of the spinal cord. The influence of the higher parts of the CNS on the reflexes of the spinal cord. Research of the basic spinal reflexes. Analysis of reflex arcs of spinal reflexes.

#### **Topic 9. The structure and functions of the brain. Stereotactic technique. EEG. Neurochemistry of the brain. Cranial nerves, classification, structure, areas of innervation.**

Structural and functional organization of the brain. Departments of the brain and their functions. Posture and movement regulation. Motor functions of the brain stem. Tonic reflexes of the medulla and midbrain. Observation of tonic reflexes when changing body position and movement. Research of elevator reaction and readiness to jump.

The role of different levels of the CNS in maintaining muscle tone and complex motor acts in the organization and implementation of motor programs of the body. Structural and functional organization of the cerebellum. Motor functions of the cerebellum.

Structural and functional organization of the thalamus. Its role in the regulation of functions. Basal ganglia (striopallidum system). Structural and functional organization of the basal ganglia. The main neurochemical ways of realization of functions of basal ganglia. Motor functions of the cerebral hemispheres. Integrative activity of motor structures of the CNS for the organization of movements. Cranial nerves, classification, structure, areas of innervation.

Stereotactic technique. Implantation of microelectrodes in various structures of the rat brain. Electroencephalography. Acquaintance with recording and EEG analysis. Ways of pharmacological correction of CNS functions.

#### **Topic 10. Structure and functions of the autonomic nervous system. Vegetative reflexes. Vegetotropic substances.**

Structural and functional features of the autonomic (autonomic) nervous system (ANS). Sympathetic, parasympathetic and intramural (metasympathetic) departments of the ANS. Classification and physiological significance of autonomic reflexes. Physiological properties of autonomic ganglia. Neurotransmitters of the autonomic nervous system. Vegetotropic substances. Pharmacological blockers of excitation transmission in the synapses of the ANS.

Synergism and relative antagonism of sympathetic and parasympathetic influences. Autonomous centers. The structure of autonomic reflexes. Autonomous components of behavior, their physiological significance. Integrative centers of regulation of visceral functions, the role of the hypothalamus.

#### **Topic 11. Humoral regulation of functions, regulatory factors. Structural and functional organization of the endocrine system. Mechanisms of action of hormones. Regulation of the endocrine glands. Structure and functions of the hypothalamic-pituitary system.**

Factors of humoral regulation - metabolic, tissue hormones, real hormones. Structural and functional organization of the endocrine system. Classification of hormones by chemical structure and action on the body. Mechanisms of action of hormones. Regulation of hormone production. Hypothalamic-pituitary system. Neurosecretory of the hypothalamus. Pituitary gland, hormones, physiological significance. The pineal gland and its hormones. Thymus, hormones, physiological significance. Tissue hormones. The concept of hormone therapy.

**Topic 12. Structure and functions of the thyroid and thyroid glands. The role of hormones in the regulation of growth and development of the organism.**

Structure and topography of the thyroid gland. Thyroid hormones: chemical structure, synthesis, transport, physiological role. Signs of deficiency and excess of iodinated thyroid hormones, methods of prevention. Thyroid glands: features of structure and function. The effect of thyroid on the molting of pigeons. The value of thyroid and thyroid hormones in the regulation of growth and development, the impact on calcium metabolism, bone condition.

**Topic 13. Structure and functions of the pancreas and adrenal glands. The role of hormones in the regulation of homeostasis and nonspecific adaptation.**

Structure and functions of the adrenal glands. Hormones of the cortical substance of the adrenal glands, their physiological role. Hormones of the adrenal medulla, their physiological role. The effect of adrenaline on the frog's heart. The effect of adrenaline and pituitrin on pigment cells of frog skin. Endocrine function of the pancreas, role in the regulation of carbohydrate, fat and protein metabolism. Effect on the whole body of adrenal hormones and insulin. Physiological basis of medical use of steroid hormones and insulin. Observation of hypoglycemic seizures in mice after insulin administration.

**Topic 14. Structure and functions of male and female genitals. The role of sex hormones in the regulation of physiological functions. Sexual cycle: its phases and regulation. Hormonal diagnosis of pregnancy.**

Male reproductive system. Development of the male reproductive system. The role of male sex hormones in the regulation of functions.

Female reproductive system, its development and regulation. Sexual cycle: its phases and regulation. Placental hormones. Determination of the phases of the sexual cycle of rats by vaginal swab. Vaginal smears of women as an indicator of the amount of estrogen in the blood. Principles of pharmacological correction of the sexual cycle.

Hormonal diagnosis of pregnancy. Ashheim-Tsondek reaction. Sperm-Galli-Mainini reaction.

**Content module 3. Physiology of sensory systems and higher integrative functions**

**Topic 15. Anatomy and physiology of skin, taste and olfactory analyzers. Physiology of hearing. Neurophysiological bases of pain and analgesia.**

The value of sensory systems in the perception of the external environment, adaptation to its changes. Systemic nature of perception. Perception of space.

Skin sensitivity. Mechanoreception (touch). Study of skin sensitivity. Determination of the threshold of tactile sensitivity. Processing of tactile information in the CNS. Thermoreception (temperature sensitivity). Pain reception (pain sensitivity). Biological significance of pain. Types of pain. Neurophysiological mechanisms of pain. Nociceptive and antinociceptive systems. Analysis of pain information in the CNS. Physiological bases of anesthesia. Ways of medical anesthesia. Olfactory sensory system - structure and functions. Taste sensory system - structure and functions. Study of taste and olfactory sensitivity.

Auditory sensory system. The structure of the ear. Functions of the outer and middle ear. The mechanism of perception of sound oscillations by receptive cells. Tone recognition. Volume recognition. Processing of sound information in the CNS. Auditory orientation in space. Determination of hearing acuity by the Voyachek method. Determination of air and bone conductivity of sound. Study of auditory orientation reactions

Vestibular sensory system. Otolith apparatus. Semicircular channels. Central departments of the vestibular system. Visceral sensory system.

**Topic 16. Anatomy and physiology of the visual analyzer. The structure of the organ of vision. Refraction and accommodation of the eye. Determination of acuity and field of view.**

Visual sensory system. The structure of the eyeball and the auxiliary apparatus of the eye. Oculomotor muscles, their innervation. Blood supply to the eye. Optical eye system. Accommodation of the eye. Optical imperfections of the eye. Anomalies of refraction of the eye. Perception and processing of signals in the retina. The mechanism of excitation of photoreceptors. Processing of visual information in retinal neurons. Signal processing at the CNS level. Perception of color. Light and dark adaptation.

Study of refraction and accommodation of the eye. Study of the pupillary reflex. Study of the effect of pharmacological agents on the pupil of the eye. Observation of the phenomenon of astigmatism. Research of visual-orienting reactions.

Determination of acuity and field of view. Determination of a blind spot according to Mariot's drawing. Determination of visual acuity of each student at the table Sivtsev. Determination of color vision according to Rabkin's tables.

**Topic 17. Conditioned-reflex activity. Higher mental functions. The role of neurotransmitters in providing higher nervous functions.**

Congenital forms of behavior. Instincts. Motivation. Acquired forms of behavior. Conditioned reflexes. Classification of conditioned reflexes. Formation of conditioned reflexes. Inhibition of conditioned reflexes. Cortical analytical-synthetic activity. Memory. Sensory memory. Short-term memory. Long-term memory. Types of higher nervous activity. Emotions. Classification of emotions. The mechanism of emotion formation. Neural basis of emotions. Manifestation of emotions. Physiological bases of mental activity. The first and second signaling systems. Speech center. Functional asymmetry of the brain. Asymmetry of mental function of the brain. Sleep. See the dream. Mechanisms of natural sleep. The role of chemicals in sleep regulation. Dreams. Physiological significance of sleep. Physiological bases of consciousness. Physiological bases of attention.

Influence of pharmacological agents on behavioral reactions.

**Topic 18. Module control 1.**

**Module 2. Physiology of visceral systems.**

**Content module 4. Anatomy and physiology of the blood, circulatory and respiratory systems**

**Topic 19. The structure of the blood system. Research of physicochemical properties of blood. Counting of formed blood elements. Erythrocyte functions Hemolysis and erythrocyte resistance. Determination of hemoglobin. Blood groups.**

The concept of the blood system. The structure of the blood system: liver, spleen, red bone marrow. The concept of liquid media: interstitial fluid, cerebrospinal fluid, fluid of closed body cavities, liquid media of the eye. Blood, functions, composition and basic physiological constants. Plasma and its composition. Plasma proteins, functions. Physico-chemical properties of blood. Blood buffer systems. Erythrocytes, structure, functions. Hemoglobin, its chemical compounds. Hemolysis. Hematopoietic organs. Regulation of hematopoiesis. Blood groups. Rhesus factor. Blood substitutes and blood products. Basics of blood transfusion.

**Topic 20. ESR. Determination of blood clotting time. Anticoagulant and fibrinolytic systems. Study of the number and function of leukocytes. The structure of the immune system. Immunity.**

Platelets structure and function. Modern idea of the mechanisms of blood clotting, regulation. Stages of hemostasis. Coagulation hemostasis: coagulation factors. Anticoagulant and fibrinolytic systems. Ways of drug correction of blood clotting processes.

Leukocyte count. The concept of leukocytosis and leukopenia. Characteristics of leukocytes. Leukocyte formula. Functions of various forms of leukocytes. Structure and functions of the thymus. Age-related involution of the thymus. Structure and functions of lymph nodes. Immunity, its types. Immunomodulators.

**Topic 21. Anatomy of the cardiovascular system. The structure of the heart. Physiological properties of the heart muscle. Leading system of the heart.**

Structural and functional organization of the cardiovascular system. Physiological essence and significance of blood circulation. Topography, heart structure. Structure and functions of heart valves. Blood supply to the heart. Cardiac cycle, its sound manifestations.

Physiological properties of the heart muscle (excitability, irritability, conductivity, contractility, automation, refractoriness). Leading system of the heart. Investigation of the functions of the conduction system of the heart using Stanius ligatures.

**Topic 22. Cardiography and recording of extrasystole. Regulation of heart activity.**

Mechanics of the heart. The concept of heart rhythm and mechanisms of its violation. Types and characteristics of extrasystoles. Mechanocardiography.

Nervous and humoral regulation of heart activity. Physiological bases of drug correction of heart work.

Introduction to the method of cooking an isolated frog heart. Study of the effect of high and low temperatures, excess  $Ca^{2+}$  and  $K^{+}$  ions.

**Topic 23. Methods of functional diagnostics of the heart (ECG, VEX, BCG, FKG, ultrasound). Functional heart tests.**

Indicators of heart activity (electrical, sound, mechanical). Instrumental methods of cardiovascular examination (ECG, EEC, BCG, FCG, ultrasound). Functional heart tests.

**Topic 24. Anatomical and topographic characteristics of blood and lymphatic vessels. Structural and functional classification of vessels.**

Large and small circulatory system. Structure and functions of the arterial part of the circulatory system. Aorta, structure of aortic walls, aortic divisions. Main arteries, their functions. Structure and functions of the venous part of the circulatory system. Upper and lower vena cava, topography, wall structure. Portal venous system, its significance. Venous valves, their role in the venous return of blood to the heart. Structural and functional features of different parts of the vascular bed, the interdependence between the structure of the vascular wall and the function of the vessel.

**Topic 25. The movement of blood in the vessels. Physiology and biophysics of hemo- and lymphodynamics. Regulation of vascular tone.**

Basic principles of hemodynamics. Vascular tone. Circulatory rate.

Microcirculation, physiological significance. Regulation of vascular tone. Vascular innervation, vascular center, pressor and depressive reflexes. Natural and artificial vasodilators and vasoconstrictors, their use in medical practice. Features of coronary circulation and the possibility of its correction by chemical means. Neurohumoral regulation of coronary vessel tone. The composition and functions of the lymph. Mechanism and regulation of lymph formation.

Blood flow through the veins, features. Blood depots are their physiological significance.

**Topic 26. Methods of functional diagnostics of vessels. Measurement of CT in humans. Pulse study.**

Blood pressure, its types. Blood pressure (systolic, diastolic, pulse, average), factors that determine its value. Methods of measuring blood pressure.

Investigation of blood flow in blood vessels (Doppler, rheovasography, contrast vasography, etc.).

Arterial pulse and its parameters. Examination of arterial pulse (palpation, sphygmography). Venous pulse, its research (phlebography).

**Topic 27. The structure of the bronchopulmonary apparatus. Definition of VL. Lung ventilation.**

Structural and functional characteristics of the respiratory system. The structure of the bronchial tree. The structure of the lungs. The value of respiration for the body. The main stages of the respiratory process. External respiration. The value of the structure of the chest to ensure external respiration. Respiratory cycle. Physiological characteristics of the respiratory tract, their functions. Biomechanics of inhalation and exhalation. Pressure in the pleural cavity, its changes during respiration. Elastic properties of the lungs and chest walls. Surfactants, their significance. Static and dynamic indicators of external respiration. Relationship between pulmonary circulation and pulmonary ventilation. Anatomical and physiological "dead space".

**Topic 28. Diffusion of gases in the lungs. Transport of gases by blood. Regulation of respiration.**

Mechanisms of gas exchange between inhaled air and alveolar gas mixture, between alveoli and blood in pulmonary capillaries. Properties of the pulmonary membrane. Diffusion capacity of the lungs.

Factors influencing the formation and dissociation of oxyhemoglobin. Oxygen and carbon dioxide content in arterial and venous blood. Oxygen capacity of blood. Formation and dissociation of bicarbonates and carbohemoglobin. The value of carbonic anhydrase. Gas exchange between blood and tissues. The voltage of oxygen and carbon dioxide in the tissue fluid and cells.

CNS structures that provide respiratory periodicity. The role of the pneumotactic center in the inhibition of inspiration, regulation of volume and respiratory rate. Apnea center, its role.

Central and peripheral chemoreceptors, their importance in ensuring gas homeostasis. Changes in lung ventilation in hypercapnia, hypoxia. The role of receptors in the regulation of respiration: irritants, j-receptors, proprioceptors.

Protective respiratory reflexes. Non-gas exchange functions of the lungs. Breathing during physical work, at high and low atmospheric pressure (caisson, mountain sickness). Regulation of the first breath of a newborn child.

Artificial respiration. Possibility of medical correction of the functional state of the respiratory center.

### **Content module 5. Anatomy and physiology of the digestive system. Energy metabolism.**

#### **Thermoregulation.**

#### **Topic 29. Anatomy and physiology of the digestive system. Study of digestion in the mouth and stomach.**

Structural and functional organization of the human digestive system. The structure of the digestive tract and its parts.

General characteristics of digestive processes. Types of digestion (intracellular, cavity, membrane).

The structure of the digestive glands. Features of secretory cells, mechanisms of secretion, the role of calcium ions and cellular mediators in the secretory process. Gastrointestinal hormones. Periodic activity of the digestive system.

Digestion in the oral cavity. Taste and olfactory sensory. Mechanical and chemical processing of food. Structure, topography and innervation of salivary glands. Salivation, quantity, composition, physiological significance of saliva. Regulation of salivation. The structure of the esophagus. Mechanism and regulation of swallowing.

Structure and topography of the stomach. Structural and functional features of the stomach. Digestion in the stomach. Functions of the stomach. Composition and properties of gastric juice. Influence of chemical factors on the secretory function of the stomach. Regulation of gastric secretion. The mechanism of food transfer from the stomach to the duodenum.

#### **Topic 30. Study of digestion in the intestine. Study of bile secretion. Suction physiology.**

Intestinal departments, their structural and functional features. Structure and function of the pancreas. Digestion in the intestines. Composition and properties of pancreatic juice. Neuro-humoral regulation of pancreatic secretion. The role of bile in digestion. Composition and properties of bile. Regulation of bile production and bile secretion.

Intestinal secretion. Cavity and membrane hydrolysis of nutrients. Digestion in the colon. The value of the microflora.

Suction physiology. The main mechanisms of absorption of hydrolysis products in different parts of the digestive tract. Ways of pharmacological influence on absorption processes.

Food motivation. Physiological bases of hunger and satiety. Representation of the digestive center.

Ways of pharmacological influence on the functional state of the human digestive system.

#### **Topic 31. Research of energy metabolism by direct and indirect calorimetry. Preparation of food rations. Thermoregulation.**

Energy exchange. Methods of research of energy metabolism. Basic exchange. Total energy metabolism. Specific-dynamic action of food. Influence of temperature. Energy exchange during work. Regulation of energy metabolism. Metabolism. Protein metabolism. Carbohydrate metabolism. Fat metabolism. Metabolism of minerals and water. Regulation of metabolism. Principles of food preparation. Thirst, hunger, satiety. Thermoregulation. Mechanisms of thermoregulation. Mechanisms for maintaining a constant body temperature. Thermoreceptors. Thermoregulation center.

### **Content module 6. Physiology of the excretory system**

#### **Topic 32. Anatomy and physiology of the excretory system. Study of urination processes.**

Morpho-functional characteristics of the kidneys. Features of blood supply to the kidneys. The structure of the nephron. The mechanism of urine formation. The structure of the renal filter. Glomerular filtration mechanism. Calculation of effective filtration pressure. The composition of primary urine. Reabsorption in the tubules. Mechanisms of reabsorption in the proximal tubules. Sodium reabsorption. Glucose reabsorption. Amino acid reabsorption. Protein reabsorption. Water reabsorption. Secretion by tubules.

#### **Topic 33. The structure and functions of the urinary organs. Selection regulation.**

Regulation of urine formation processes. Incretory function of the kidneys. Participation of the kidneys in maintaining acid-base balance. Metabolic function of the kidneys and secretion of metabolic products. Structure and functions of the urinary organs: ureters, bladder, urethra. The mechanism of

urination. Functional bases of diuretics application. Physiological principles of kidney function research. Excretory function of other organs. Secretion of diagnostic and therapeutic agents. The concept of "artificial kidney".

**Topic 34. Practical skills and test control.**

**Topic 35. Module control 2.**

## 9. STRUCTURE OF EDUCATIONAL DISCIPLINE

Names of content modules and topics	Amount of hours				
	Total	including			
		Classroom		Independent students' work	Individual work
		Lectures	Practicals		
1	2	3	4	5	6
<b>Module 1. Anatomy and physiology of the musculoskeletal system and regulatory systems</b>					
<b>Content module 1. Introduction to human anatomy and physiology. Structure and functions of musculoskeletal structures.</b>					
Topic 1. Anatomy and physiology as a science of the structure and function of the human body. Research methods in anatomy and physiology. Fundamentals of a physiological experiment. The concept of the structural and functional organization of the human body.	3,5	0,5	2	1	-
Topic 2. General structure of the cell. Types of cells and tissues. Structure and functions of the cell membrane. Characteristics of excitable tissues	3,5	0,5	2	1	-
Topic 3. Bioelectric phenomena in excitable tissues. Physiological properties of nerve fibers. The laws of excitability. Physiology of synapses	3,5	0,5	2	1	
Topic 4. Mechanism of muscle contraction. Types and modes of muscle contractions. Muscle work and Strength.	3,5	0,5	2	1	
Topic 5. Anatomy of the musculoskeletal system. Types of bones and joints. The structure of the skeleton. Anatomy of bones and joints of the body and limbs. General information about the structure and connection of the bones of the skull.	5	1	2	2	
Topic 6. Muscular system. Types of muscles. The structure and functions of the muscles of the trunk, upper and lower limbs. Structure and function of the head and neck muscles	4	1	2	1	

<b>Total on the content module 1</b>	<b>23</b>	<b>4</b>	<b>12</b>	<b>7</b>	<b>-</b>
<b>Content module 2. Structure and functions of regulatory systems of the organism.</b>					
Topic 7. General anatomy of the central and peripheral nervous system. Analysis of the reflex arc. Reflex time. Excitation and inhibition processes in the CNS.	4	1,0	2	1	-
Topic 8. The structure and functions of the spinal cord. Spinal nerves, their functions.	3,5	0,5	2	1	-
Topic 9. The structure and functions of the brain. Stereotaxic technique. EEG. Neurochemistry of the brain. Cranial nerves, classification, structure, areas of innervation.	3,5	0,5	2	1	-
Topic 10. Structure and functions of the autonomic nervous system. Vegetative reflexes. Vegetotropic substances.	5	2,0	2	1	-
Topic 11. Structure and functions of the endocrine system. Humoral regulation of functions, factors of regulation. Mechanisms of action of hormones. Regulation of glands of internal secretion. Structure and functions of the hypothalamic-pituitary system	3,5	0,5	2	1	-
Topic 12. The structure and function of the thyroid and parathyroid glands. The role of hormones in the regulation of growth and development of the body.	3,5	0,5	2	1	-
Topic 13. The structure and functions of the pancreas and adrenal glands. The role of hormones in the regulation of homeostasis and nonspecific adaptation.	3,5	0,5	2	1	-
Topic 14. The structure and functions of the male and female genital organs. The role of sex hormones in the regulation of physiological functions. The sexual cycle: its phases and regulation. Pregnancy tests.	3,5	0,5	2	1	-
<b>Total on the content module 2</b>	<b>30</b>	<b>6</b>	<b>16</b>	<b>8</b>	<b>-</b>
<b>Content module 3. Physiology of sensory systems and higher integrative functions</b>					
Topic 15. Anatomy and physiology of skin, taste and olfactory analyzers. Physiology of hearing. Neurophysiological bases of pain	5	1,0	2	2	-



and anesthesia.					
Topic 16. Anatomy and physiology of visual analyzer. The structure of the organ of vision. Refraction and accommodation of the eye. Definition of acuity and field of view.	4	1,0	2	1	-
Topic 17. Conditional reflex activity. Higher mental functions. The role of neurotransmitters in the provision of higher nerve functions.	6	2	2	2	-
<b>Total on the content module 3</b>	<b>15</b>	<b>4</b>	<b>6</b>	<b>5</b>	<b>-</b>
Topic 18. Final module control 1	7	-	2	5	-
<b>TOTAL HOURS</b>	<b>75</b>	<b>14</b>	<b>36</b>	<b>25</b>	<b>-</b>
<b>Module 2. Anatomy and physiology of visceral systems</b>					
<b>Content module 4. Anatomy and physiology of the blood, circulatory and respiratory systems</b>					
Topic 19. The structure of the organs of the blood system. Investigation of physico-chemical properties of blood. Blood cells counting. Functions of red blood cells. Hemolysis and erythrocyte resistance. Determination of hemoglobin. Blood groups.	4	1	2	1	-
Topic 20. Erythrocyte sedimentation rate. Determination of clotting time. Anticoagulant and fibrinolytic systems. Research the number and function of white blood cells. The structure of the immune system. Immunity.	4	1	2	1	-
Topic 21. Anatomy of the cardiovascular system. The structure of the heart. Physiological properties of the heart muscle. The conductive system of the heart.	4	1	2	1	
Topic 22. Cardiography and extrasystole recording. Regulation of heart activity.	3,5	0,5	2	1	-
Topic 23. Methods of functional diagnostics of the heart. Functional tests of the heart.	3,5	0,5	2	1	-
Topic 24. Anatomic and topographic characteristics of blood and lymphatic vessels. Structural and functional classification of vessels.	3,5	0,5	2	1	
Topic 25. The blood flow in blood vessels. Physiology and biophysics of hemo- and lymphodynamics. Regulation of vascular tone.	5	1	2	2	
Topic 26. Methods of functional	3,5	0,5	2	1	-

diagnostics of vessels. Measurement of arterial pressure. Heart rate research.					
Topic 27. The structure of the bronchopulmonary apparatus. Measurement of the vital capacity of the lungs. Lung ventilation.	4	1	2	1	-
Topic 28. Diffusion of gases in the lungs. Gases exchange in a blood. Respiratory regulation.	4	1	2	1	
<b>Total on the content module 4</b>	<b>39</b>	<b>8</b>	<b>20</b>	<b>11</b>	<b>-</b>
<b>Content module 5. Anatomy and physiology of the digestive system. Energy metabolism. Thermoregulation</b>					
Topic 29. Anatomy and physiology of the digestive system. Studies of digestion in the oral cavity and stomach.	4	1	2	1	
Topic 30. Studies of digestion in the intestine. Bile excretion. Physiology of absorption.	4	1	2	1	
Topic 31. Determination of the basal metabolic rate (BMR) by the of direct and indirect calorimetry. Composition of nutritional requirements (diet) for the students. Thermoregulation.	5	2	2	1	
<b>Total on the content module 5</b>	<b>13</b>	<b>4</b>	<b>6</b>	<b>3</b>	<b>-</b>
<b>Content module 6. Physiology of the excretory system</b>					
Topic 32. Anatomy and physiology of the excretory system. Study of processes of urine formation.	5	1	2	2	-
Topic 33. Structure and functions of the urinary organs. Regulation of kidneys functions.	4	1	2	1	
<b>Total on the content module 6</b>	<b>9</b>	<b>2</b>	<b>4</b>	<b>3</b>	<b>-</b>
Topic 34. Practical skills and test control	<b>5</b>	<b>-</b>	<b>2</b>	<b>3</b>	<b>-</b>
Topic 35. Final module control 2	<b>7</b>	<b>-</b>	<b>2</b>	<b>5</b>	<b>-</b>
<b>TOTAL HOURS</b>	<b>75</b>	<b>16</b>	<b>34</b>	<b>25</b>	<b>-</b>

## 10. THEMATIC PLAN OF LECTURES

No	Name f topic	Amount of hours
<b>Module 1. Anatomy and physiology of the musculoskeletal system and regulatory systems</b>		
1	The concept of the structure and function of the human body. Structural and functional organization of the body. Physiology and biophysics of excitable tissues.	2
2	Anatomy of the musculoskeletal system. Structure and muscle functions.	2
3	Anatomy and physiology of the nervous system. Neurochemistry of the brain.	2
4	The structure and functions of the autonomic nervous system. Vegetative reflexes.	2

	Vegetotropic substances.	
5	Anatomy and physiology of glands of the internal secretion. The role of hormones in the regulation of body functions.	2
6	Anatomy and physiology of analyzers.	2
7	Physiology of higher nervous activity. Formation of behavior. Neurochemistry of Behavioral Reactions.	2
<b>Module 2. Anatomy and physiology of visceral systems</b>		
8	The concept of the internal environment of the organism. Blood system. Structure and functions of the hematopoietic organs. Structure and functions of the blood. Immunity.	2
9	Anatomy of the cardiovascular system. The structure of the heart. The properties of the heart muscle. Regulation of heart activity.	2
10	Anatomical and topographical characteristics of the blood and lymph vessels. Physiology and biophysics of hemo- and lymphodynamics.	2
11	Structural and functional organization of the respiratory system. Physiology of breathing.	2
12	Anatomy and physiology of the digestive system. Digestion in the oral cavity and stomach. Digestion in the intestine.	2
13	Structural and functional organization of bile secretion. Physiology of absorption. Regulation of digestive system activity.	2
14	The metabolism and energy. Thermoregulation.	2
15	Anatomy and physiology of the urinary system. Physiology of urine formation and urination.	2
	<b>Total</b>	<b>30</b>

## 11. THEMATIC PLAN OF PRACTICAL CLASSES

№	Name of topic	Amount of hours
<b>Module 1. Anatomy and physiology of the musculoskeletal system and regulatory systems</b>		
1	Anatomy and physiology as a science of the structure and function of the human body. Research methods in anatomy and physiology. Fundamentals of a physiological experiment. The concept of the structural and functional organization of the human body.	2
2	General structure of the cell. Types of cells and tissues. Structure and functions of the cell membrane. Characteristics of excitable tissues	2
3	Bioelectric phenomena in excitable tissues. Physiological properties of nerve fibers. The laws of excitability. Physiology of synapses	2
4	Mechanism of muscle contraction. Types and modes of muscle contractions. Muscle work and Strength.	2
5	Anatomy of the musculoskeletal system. Types of bones and joints. The structure of the skeleton. Anatomy of bones and joints of the body and limbs. General information about the structure and connection of the bones of the skull.	2
6	Muscular system. Types of muscles. The structure and functions of the muscles of the trunk, upper and lower limbs. Structure and function of the head and neck muscles	2
7	General anatomy of the central and peripheral nervous system. Analysis of the reflex arc. Reflex time. Excitation and inhibition processes in the CNS.	2
8	The structure and functions of the spinal cord. Spinal nerves, their functions.	2
9	The structure and functions of the brain. Stereotaxic technique. EEG. Neurochemistry of the brain. Cranial nerves, classification, structure, areas of innervation.	2
10	Structure and functions of the autonomic nervous system. Vegetative reflexes. Vegetotropic substances.	2
11	Structure and functions of the endocrine system. Humoral regulation of functions,	2

	factors of regulation. Mechanisms of action of hormones. Regulation of glands of internal secretion. Structure and functions of the hypothalamic-pituitary system	
12	The structure and function of the thyroid and parathyroid glands. The role of hormones in the regulation of growth and development of the body.	2
13	The structure and functions of the pancreas and adrenal glands. The role of hormones in the regulation of homeostasis and nonspecific adaptation.	2
14	The structure and functions of the male and female genital organs. The role of sex hormones in the regulation of physiological functions. The sexual cycle: its phases and regulation. Pregnancy tests.	2
15	Anatomy and physiology of skin, taste and olfactory analyzers. Physiology of hearing. Neurophysiological bases of pain and anesthesia.	2
16	Anatomy and physiology of visual analyzer. The structure of the organ of vision. Refraction and accommodation of the eye. Definition of acuity and field of view.	2
17	Conditional reflex activity. Higher mental functions. The role of neurotransmitters in the provision of higher nerve functions.	2
18	Final module control 1	2
<b>Module 2. Anatomy and physiology of visceral systems</b>		
19	The structure of the organs of the blood system. Investigation of physico-chemical properties of blood. Blood cells counting. Functions of red blood cells. Hemolysis and erythrocyte resistance. Determination of hemoglobin. Blood groups.	2
20	Erythrocyte sedimentation rate. Determination of clotting time. Anticoagulant and fibrinolytic systems. Research the number and function of white blood cells. The structure of the immune system. Immunity.	2
21	Anatomy of the cardiovascular system. The structure of the heart. Physiological properties of the heart muscle. The conductive system of the heart.	2
22	Cardiography and extrasystole recording. Regulation of heart activity.	2
23	Methods of functional diagnostics of the heart. Functional tests of the heart.	2
24	Anatomic and topographic characteristics of blood and lymphatic vessels. Structural and functional classification of vessels.	2
25	The blood flow in blood vessels. Physiology and biophysics of hemo- and lymphodynamics. Regulation of vascular tone.	2
26	Methods of functional diagnostics of vessels. Measurement of arterial pressure. Heart rate research.	2
27	The structure of the bronchopulmonary apparatus. Measurement of the vital capacity of the lungs. Lung ventilation.	2
28	Diffusion of gases in the lungs. Gases exchange in a blood. Respiratory regulation.	2
29	Anatomy and physiology of the digestive system. Studies of digestion in the oral cavity and stomach.	2
30	Studies of digestion in the intestine. Bile excretion. Physiology of absorption.	2
31	Determination of the basal metabolic rate (BMR) by the of direct and indirect calorimetry. Composition of nutritional requirements (diet) for the students. Thermoregulation.	2
32	Anatomy and physiology of the excretory system. Study of processes of urine formation.	2
33	Structure and functions of the urinary organs. Regulation of kidneys functions.	2
34	Practical skills and test control	2
35	Final module control 2	2
	<b>Total</b>	<b>70</b>

## 12. THEMATIC PLAN OF INDIVIDUAL WORK

№	Name of topic	Amount of hours
<b>Module 1. Anatomy and physiology of the musculoskeletal system and regulatory systems</b>		
1	Preparation for practical classes - theoretical training and development of practical skills.	18
2	Independent elaboration of topics that are not included in the lesson plan:	
	Opiate and non-opiate antinociceptive systems of the body, their significance.	1
	Neurochemistry of the brain. The role of neurotransmitter systems in the regulation of integrative functions	1
3	Preparation for the final module control including test control.	5
	Total	25
<b>Module 2. Anatomy and physiology of visceral systems</b>		
1	Preparation for practical classes - theoretical training and development of practical skills.	15
2	Independent elaboration of topics that are not included in the lesson plan:	
	The role of the kidneys in the regulation of homeostasis parameters	1
	Structural and functional features of regional blood circulation	1
3	Preparation for the final module control including test control.	8
	Total	25
	<i>Total self-discipline, including preparation for final control module</i>	50
		13

## 13. LIST OF INDIVIDUAL TASKS (*Activity optional*)

1. Speeches at the scientific student group.
2. Participation in scientific conferences.
3. Publication of reports in the form of abstracts and articles in periodicals (journals, collections of scientific papers).
4. Making visual aids according to educational programs (tables, models, visual aids, graphological schemes of practical classes).
5. Writing abstracts

## 14. LIST OF THEORETICAL TASKS TO THE FINAL MODULE CONTROL

### Module 1. Anatomy and physiology of the musculoskeletal system and regulatory systems

#### Content module 1. Introduction to human anatomy and physiology. Structure and functions of musculoskeletal structures.

1. Anatomy as a science of the structure of organs and systems of the human body.
2. Physiology as a science.
3. The concept of functions.
4. Methods of physiological research.
5. Formation and development of physiology in the XIX century.
6. Ukrainian School of Physiology.
7. The body, the elements that make it up.
8. Levels of structural and functional organization of the human body.
9. The concept of tissues, organs, systems, principles of their structural and functional interaction in ensuring the normal flow of functions.
10. The structure of the cell, its main components.
11. The concept of body tissues, types of tissues and cells that make them up.
12. The structure of the cell membrane.
13. Types of transport of substances across cell membranes. Cellular channels and pumps.
14. Rest potential, mechanisms of origin, its parameters, physiological role.
15. Action potential, mechanisms of origin, its parameters, physiological role.

16. Excitability. Critical level of depolarization, threshold of cell membrane depolarization.
17. Mechanisms of excitation by nerve fibers.
18. Mechanisms of excitation transmission through neuromuscular synapse.
19. Mechanisms of contraction and relaxation of skeletal muscles.
20. Types of muscle contractions: single and tetanic; isotonic and isometric.
21. Ways to correct the functional state of excitable tissues by pharmacological agents.
22. The concept of musculoskeletal system, its functions.
23. General data about the skeletal system.
24. Bone as an organ, chemical composition and internal structure of bone.
25. Classification of bones.
26. Types of bone joints, their functional significance.
27. Structure and functions of trunk bones and their joints.
28. The structure and function of the bones of the upper extremity and their joints.
29. The structure and function of the bones of the lower extremity and their joints.
30. Skull bones and their connections. Functions of the bones of the brain and facial skull.
31. The concept of muscle as an organ.
32. Structural and functional classification of muscles.
33. Auxiliary muscle apparatus.
34. The concept of skeletal muscle, their general function.
35. The structure and function of the muscles of the head and neck.
36. The structure and function of the muscles of the torso.
37. The structure and function of the muscles of the upper extremities.
38. The structure and function of the muscles of the lower extremities.

**Content module 2. Structure and functions of regulatory systems of the organism.**

39. Biological regulation, its types and significance for the organism.
40. Structural and functional organization of the nervous system.
41. Neuron - a structural and functional unit of the CNS.
42. The concept of reflex. The structure of the reflex arc and the function of its links.
43. Mechanisms and patterns of excitation transmission in the central synapses.
44. Types of central braking. Mechanisms of development of presynaptic and postsynaptic inhibition.
45. Synapse as a site of action of pharmacological agents.
46. Structural organization of the spinal cord. Structural and functional features of gray and white matter of the spinal cord.
47. Conductive function of the spinal cord.
48. The roots of the spinal cord, the law of Bella Majandi.
49. Spinal nerves and their plexuses, areas of innervation.
50. The structure and function of the brain.
51. The structure of the brain stem, midbrain and diencephalon.
52. The structure and functions of the cerebellum.
53. The structure and function of the cerebral cortex.
54. Cranial nerves, their topography and areas of innervation.
55. Regulation of posture and movements. The role of different parts of the CNS in the regulation of motor functions of the body.
56. General plan of the structure of the autonomic nervous system.
57. Synapses of the autonomic nervous system, their mediators, cytoresceptors.
58. Peripheral autonomic nerves, their functions.
59. Influence of the sympathetic nervous system on visceral functions.
60. Influence of parasympathetic nervous system on visceral functions.
61. The role of the intramural (metasympathetic) system in the regulation of visceral functions.
62. The unity of the sympathetic and parasympathetic systems in the regulation of body functions.
63. Humoral regulation of its difference from the nervous.
64. The structure of the endocrine system.
65. Properties of hormones, their main effects. The mechanism of action of hormones on target cells.

66. Structure and topography of the hypothalamic-pituitary system. The role of the hypothalamic-pituitary system in the regulation of endocrine glands.
67. The structure and function of the thyroid and thyroid glands.
68. The structure and function of the adrenal glands.
69. Structure and functions of the endocrine part of the pancreas.
70. The role of somatotropic, thyroxine and triiodothyronine, insulin in the regulation of mental and physical development of the body and linear growth of the body.
71. The role of calcitonin, parathyroid hormone, calcitriol in the regulation of the concentration of calcium ions and phosphates in the blood.
72. The role of pancreatic hormones in the regulation of body functions.
73. The role of thyroid hormones in the regulation of body functions.
74. The role of thyroid hormones in the regulation of body functions.
75. The role of breast hormones (thymus) in the regulation of body functions.
76. The structure of the pineal gland. The role of the pineal gland in the regulation of body functions.
77. Male reproductive system. Development of the male reproductive system. The role of male sex hormones in the regulation of functions.
78. Female reproductive system, its development and regulation.
79. The role of sex hormones in the regulation of body functions.
80. General idea of non-specific adaptation of the organism to a stressful situation.
- Content module 3. Anatomy and physiology of sensory systems. Higher integrative functions**
81. Sensory systems, their structure and functions.
82. Taste sensory system, its structure, functions, research methods
83. Olfactory sensory system, its structure and functions.
84. Somato-sensory system, its structure and functions.
85. Physiological mechanisms of pain.
86. Opiate and non-opiate antinociceptive systems of the body, their importance.
87. Physiological mechanisms of anesthesia.
88. Auditory sensory system, its structure and functions. Functions of the outer and middle ear. Inner ear, frequency analysis of sound signals.
89. Visual sensory system, its structure and functions.
90. The structure of the eyeball and the auxiliary apparatus of the eye. Oculomotor muscles, their innervation. Blood supply to the eye.
91. The main visual functions and methods of their study.
92. Biological forms of behavior. Innate forms of behavior, instincts, their physiological role.
93. Acquired forms of behavior. Conditions for the formation of conditioned reflexes, their differences from unconditioned.
94. Memory, types and mechanisms of education.
95. Needs and motivations, their role in shaping behavior.
96. Emotions, mechanisms of formation, biological role.
97. Functions of the new cerebral cortex and higher human nervous activity.
98. The influence of pharmacological agents on behavioral reactions.
99. Language, its functions, physiological bases of formation.
100. Thinking. Development of abstract thinking in man. The role of brain structures in the thinking process.
101. Types of higher human nervous activity. Temperament and character.
102. Physiological bases of labor activity of the person. Features of physical and mental work. Optimal operating modes.
103. Physiological mechanisms of fatigue. Active rest and its mechanisms.
104. Age-related changes in human performance.
105. Sleep, its types, phases, electrical activity of the cortex, physiological mechanisms.

## **Module 2. Anatomy and physiology of visceral systems**

### **Content module 4. Anatomy and physiology of the blood, circulatory and respiratory systems.**

**General characteristics of the blood system. Composition and functions of blood. The concept of homeostasis.**

106. The structure of the blood system: liver, spleen, red bone marrow.
107. Osmotic blood pressure and its regulation.
108. Blood plasma proteins and their functional significance. Oncotic blood plasma pressure and its significance.
109. Erythrocyte sedimentation rate.
110. Buffer blood systems.
111. Shaped elements of blood and their function.
112. Mechanisms of hemostasis. Coagulants, anticoagulants, fibrinolysis factors, their physiological significance.
113. Physiological characteristics of blood groups of the ABO system, Rh. Rhesus conflicts.
114. General characteristics of the circulatory system.
115. Topography, structure of the heart. Structure and functions of heart valves. Blood supply to the heart.
116. Conducting system of the heart. Automaticity of the heart. Gradient of automatism.
117. Mechanisms of regulation of cardiac activity.
118. The basic law of hemodynamics.
119. Large and small circulatory system.
120. The structure and function of the arterial part of the circulatory system.
121. Aorta, structure of aortic walls, aortic divisions.
122. Structure and functions of the venous part of the circulatory system.
123. Upper and lower vena cava, topography, wall structure.
124. Portal venous system, its significance.
125. Venous valves, their role in the venous return of blood to the heart.
126. Structural and functional features of different parts of the vascular bed, the interdependence between the structure of the vascular wall and the function of the vessel.
127. Blood pressure, factors that determine its value. Methods of blood pressure registration.
128. Regulation of vascular tone.
129. The role of pharmacological compounds in the correction of cardiovascular disorders.
130. General characteristics of the respiratory system. Biomechanics of inhalation and exhalation.
131. Structural and functional characteristics of the respiratory system.
132. The structure of the bronchial tree.
133. The structure of the lungs.
134. The value of the structure of the chest to ensure external respiration.
135. External respiration. External respiration rates and their evaluation.
136. Transport of gases by blood. Oxygen capacity of blood.
137. Physiological role of the respiratory tract, regulation of their lumen.
138. Respiratory center, its structure, regulation of respiration.

**Content module 5. Anatomy and physiology of the digestive system. Energy metabolism. Thermoregulation.**

139. Structural and functional organization of the human digestive system. The structure of the digestive tract and its parts.
140. The structure of the digestive glands.
141. Structure, topography and innervation of salivary glands.
142. The structure of the esophagus.
143. Structure and topography of the stomach. Structural and functional features of the stomach.
144. Departments of intestines, their structural and functional features.
145. Structure and function of the pancreas.
146. The structure of the biliary system.
147. Digestion in the oral cavity. The composition of saliva, its role in digestion.
148. Regulation of salivation. Influence of stimulus properties on the quantity and quality of saliva.
149. Gastric juice, composition and properties, phases of regulation of gastric secretion.



150. Methods for studying the secretion of pancreatic juice in humans. Composition and properties of pancreatic juice.
151. Phases of regulation of secretory function of the pancreas.
152. Methods of research of bile excretion at the person. Composition and properties of bile.
153. The composition and properties of intestinal juice. Regulation of its secretion. Cavity and membrane digestion.
154. Absorption in the digestive tract. Suction mechanisms.
155. Motor function of the intestines, types of contractions, their regulation.
156. Physiological mechanisms of hunger and satiety.
157. Correction of the functional state of the gastrointestinal tract by drugs.
158. Sources and ways of using energy in the human body.
159. Methods for determining human energy consumption.
160. The basic exchange and conditions of its definition, the factors influencing its size.
161. Work exchange, the meaning of its definition.
162. Human body temperature, its daily fluctuations.
163. Center of thermoregulation. Thermoreceptors.
164. Heat production in the body, its regulation.
165. Heat transfer in the body, its regulation.
166. Possibilities of correction of human heat balance by pharmacological means.

### **Content module 6. Anatomy and physiology of the excretory system.**

167. General characteristics of the selection system.
168. Morpho-functional characteristics of the kidneys. Features of blood supply to the kidneys.
169. The structure of the nephron.
170. The structure of the renal filter.
171. Mechanisms of urination.
172. Reabsorption and secretion in the nephron, their physiological mechanisms.
173. Rotary-countercurrent-multiplying system of nephrons.
174. Regulation of renal function.
175. The structure and functions of the urinary organs: ureters, bladder, urethra.
176. The role of excretory organs in maintaining homeostasis.

## **15. LIST OF PRACTICAL SKILLS AND TASKS TO THE FINAL MODULE CONTROL**

### **Module 1. Anatomy and physiology of the musculoskeletal system and regulatory systems**

1. Calculate the parameters of functions and graphically display the processes occurring in excitable structures.
2. Draw a diagram and explain the structure and mechanisms:
  - contours of biological regulation, reflex arcs of motor reflexes;
  - development of processes of excitation and inhibition in the CNS, the processes of their summation and coordination of reflexes;
  - reflex arcs of motor reflexes at all levels of the CNS and conductive pathways that ensure the interaction of different levels of the CNS;
  - reflex arcs of autonomic reflexes, providing regulation of visceral functions;
  - the action of various hormones on target cells and the regulation of their secretion, the contours of regulation of visceral functions with the participation of hormones.
3. Assess the state of sensor systems on the indicators of the study of their functions.
4. Draw diagrams of the structure of specific channels of information transmission in sensory systems and explain the mechanisms of formation of the corresponding sensations and images of external reality.
5. Draw diagrams explaining the formation of biological forms of behavior and interpret the mechanisms of each of its stages, the role of emotions in behavior.
6. Evaluate and interpret the results of studies characterizing the types of human GNI.
7. Assess the state of the body during exercise on the indicators of functions.

## Module 2. Anatomy and physiology of visceral systems

1. Determine the content of hemoglobin in the blood by the method of Sally, evaluate the results.
2. Determine the group of blood tested in the system AB0, draw conclusions.
3. Calculate the color index of blood, draw conclusions.
4. Determine the hematocrit, draw conclusions.
5. To determine the level of blood pressure in the subject, to draw a conclusion.
6. To determine the duration of the cardiac cycle and its phases on the basis of polycardiogram analysis, to draw a conclusion.
12. Calculate the duration of the interval P-Q based on ECG analysis. Conclude.
13. Calculate the duration of the Q-T interval based on ECG analysis. Conclude.
14. Calculate the duration of the QRS complex based on ECG analysis. Conclude.
15. Determine on the basis of ECG analysis, which is the driver of the heart rhythm. Argue the conclusion.
16. Determine the vital capacity of the lungs by spirometry. Conclude.
17. Determine the tidal volume by spirometry. Conclude.
18. Determine the reserve volume of exhalation by spirometry. Conclude.
- 19 Calculate the basic metabolism of the subject, determining the oxygen consumption by a spirogram recorded in standard conditions, draw a conclusion.
20. Perform tests with respiratory arrest. Analyze the results.
21. How and why will salivation change after administration of atropine to humans?
22. Assess the secretory function of the stomach in humans.
23. Why at increase of acidity of gastric juice recommend a dairy diet?
24. How and why will the secretion of pancreatic juice change with decreasing acidity of gastric juice?
25. How will the reduction of bile acids in bile affect the digestive process? Why?
26. Suggest means of strengthening the motor function of the intestines. Give them a physiological argument.
27. How and why will the amount and composition of gastric and pancreatic juices change when fat enters the duodenum?
28. How and why will the amount and composition of gastric and pancreatic juices change when cabbage juice enters the stomach?
29. To evaluate the results of the study of renal function by general analysis of urine, by analysis of urine by Zymnytsky, by Nechiporenko.

## 16. METHODS AND FORMS OF IMPLEMENTATION OF THE CONTROL

During the study of the discipline, all types of student activities are subject to control, both current (at each lesson) and final (during control activities).

Modular control is a diagnosis of the student's assimilation of the module material (credit). The semester ends with a final module control.

1. **The initial level** of knowledge is determined in the first practical lesson with the help of a written test, which consists of test tasks.

2. **Current control** is carried out in practical classes in accordance with the specific objectives of each topic in the form:

- individual oral interview of students on theoretical issues based on the recommended literature, which are included in the methodological developments on relevant topics;
- solving situational problems on the topic of the lesson on the basis of recommendations in methodological developments, selection of tasks, relevant methodological materials of the department, task books, workshops;
- in the form of test tasks with one or more correct answers;
- in the form of written tests.

3. **Final control:** is carried out upon completion of the module and includes control of theoretical knowledge, practical skills and abilities.

## 17. EVALUATION OF THE LEVEL OF STUDENT TRAINING IN THE DISCIPLINE

During the assessment of mastering each topic, the student is graded on a 4-point (traditional) scale and on a 200-point scale using the accepted and approved assessment criteria for the relevant discipline. This takes into account all types of work provided by the methodological development for the study of the topic.

The student must receive a grade on each topic. Grades on the traditional scale are converted into points depending on the number of topics.

The weight of each topic within one module in points should be the same. Forms of assessment of current educational activities should be standardized and include control of theoretical and practical training. The final score for current activities is recognized as the arithmetic sum of scores for each lesson and for individual work. The maximum number of points that can be obtained by the applicant for the current activity during the study of the discipline is calculated by multiplying the number of points corresponding to the grade "5" by the number of topics with added points for the individual task, but not more than 200 points.

Number of module number of study hours / number of credits ECTS	Number of content modules, their numbers	Number of practical classes	Conversion into point of the traditional scale				Scores for individual task	Minimum score *
			Traditional scale					
			"5"	"4"	"3"	"2"		
Module 1 75/2,5	3 (№№ 1-3)	16	7,5	6	4,5	0	72	16
Module 2 75/2,5	3 (№№ 4-6)	16	7,5	6	4,5	0	72	16

**The maximum number of points that a student can score when studying the module is 120 points.** It is calculated by multiplying the number of points corresponding to the grade "5" by the number of topics in the module.

**The minimum number of points that a student can score while studying the module is 72 points.** It is calculated by multiplying the number of points corresponding to the grade "3" by the number of topics in the module.

**The total amount of points for current educational activities may not exceed 120 points.**

### Assessment of independent work.

Students' independent work, which is provided by the topic of the lesson along with the classroom work, is assessed during the current control of the topic in the relevant lesson. Assimilation of topics that are submitted only for independent work is checked during the final module control.

### Final module control:

The final module control is carried out upon completion of the study of all topics of the module at the last control lesson from the module.

Students who have completed all types of work provided by the curriculum, and during the study of the module scored a number of points not less than the minimum are allowed to the final control. Students are admitted to the final modular control under the condition of enrolled ICRS.

**The maximum number of points of the final modular control is 80.**

The final module control is considered credited if the student has scored at least 50 points.

## 18. RECOMMENDED LITERATURE

### 19.1 Basic

1. Анатомія людини: у 3 т. : нац. підруч. для студ. ВМНЗ IV р. а. Т. 1 / А. С. Головацький, В. Г. Черкасов, М. Р. Сапін [та ін.] ; за ред. А. С. Головацького та В. Г. Черкасова. - Вид. 6-е, доопр. - Вінниця : Нова Книга, 2017. - 364 с. : іл. - Бібліогр.: с. 364.

2. Основи фізіології: Навчально-методичний посібник / Ходоровський Г.І., Ткачук С.С., Швець В.І., Кузнецова О.В., Тимофійчук І.Р., Анохіна С.І., Гордієнко В.В., Куровська В.О., Семененко С.Б., Повар М.А.// Чернівці, 2014. – 560 с.
3. Кривецький В.В., Лютик М.Д., Луканьова С.М., Дибель О.В. Анатомія людини з основами фізіології: підруч. для студ. I-II р.а. Чернівці: Місто, 2017. 368 с.
4. Фізіологія: підруч. для студ. ВМНЗ IV р. а. /за ред. В. Г. Шевчука. 2-е вид., випр. і допов. Вінниця: Нова Книга, 2015. 447 с.
5. Hall, J. Textbook of Medical Physiology : manual / J. E. Hall, A. C. Guyton. -13th ed., International Edition. -Philadelphia : Elsevier, 2015. -1145 p. : il.

## 19.2. Auxillary

1. Анатомія нервової системи та органів чуття: навч.-метод. посіб. / [В. В. Кривецький, Н. Б. Решетілова, Ф. Д. Марчук та ін.] ; М-во охорони здоров'я України, ВДНЗ України "Буковин. держ. мед. ун-т" . -Чернівці : Медик, 2018. -103 с .
2. Головацький А.С. Анатомія людини / А.С. Головацький, В.Г. Черкасов, М.Р. Сапин, А.І. Парахін. – Вінниця, «Нова книга», 2007.
3. Агаджанян НА., Смирнов В.М. Нормальная физиология: Ученик для студентов медицинских вузов. - М.: ООО „Медицинское информационное агенство". - 2007. -520 с.
4. Анатомія опорно-рухового апарату та нутрощів: навч.-метод. посіб. /укл.В.В. Кривецький, Н.Б. Решетілова, Ф.Д. Марчук. Чернівці: Медик, 2017. 99 с.
5. Анатомія та фізіологія людини: навчальний посібник/Укл.:Лютик М.Д., Макар Б.Г., Луканьова С.М., Шумко Б.І.- Чернівці, 2006.
6. Посібник з фізіології: навч. посіб. для студ. вищ. мед. навч. закл. /за ред. В.Г. Шевчука. Вінниця: Нова книга, 2005. 564 с.
7. Анатомія людини: навчальний посібник / Хмара Т.В.та ін. // Чернівці: Медуніверситет, 2012.
8. Фізіологія нейрогуморальної регуляції: навч. посіб. / С. С. Ткачук, О. В. Ясінська, С. Б. Семененко [та ін.] ; М-во охорони здоров'я України, ВДНЗ України "Буковин. держ. мед. ун-т". - Чернівці : БДМУ, 2017. -199 с. : іл. -Бібліогр.: с. 198-199.
9. Англо-Український ілюстрований медичний словник Дорланда: У 2 т. - Львів: „Наутілус". - 2002. - 268 с, 820 іл.
10. Людина: Навчальний посібник з анатомії та фізіології. 3-є оновлене видання.-Львів, 2003.
11. Нормальна фізіологія: підручник /Терноп. держ. мед. акад. ім. І. Горбачевського. - Тернопіль, 2005. -1 ел. опт. диск (CD-ROM)
12. Фізіологія людини. Вільям Ф.Ганонг. Переклад з англ. Львів: БаК, 2002. - 784 с.
13. Фізіологія. Навчально-методичний посібник / за ред. Г.І. Ходоровського, С.С. Ткачук, В.І. Швеця.- Чернівці, 2013.
14. Фізіологія людини в питаннях і відповідях // В.І. Філімонов Навчальний посібник.- Вінниця: Нова книга, 2010 - 455.
15. Філімонов В.І. Фізіологія людини: підруч. для студ. ВМНЗ I-III р. а. Київ: Медицина, 2011. 487 с.
16. F. H. Netter. Atlas of Human Anatomy. – Ciba Pharmaceuticals Division, 2004. - 514 p.
17. Gray's. Atlas of anatomy. Richard L. Drake A., Wayne Vogl ,Adam W. M.Mitchell and others.Churchill Livingstone, 2008, 558 P.
18. Kelly, Laurie J.Essentials of human physiology for pharmacy / by Laurie J. Kelly p. ; cm., 381 P.
19. Moore, K. Clinically Oriented Anatomy : manual / K. L. Moore, A. F. Dalley II, A. M. R. Agur. -8th ed., International Edition. -Philadelphia ; Baltimore ; New York : Wolters Kluwer, 2017. -1153 p. : il. Scanlon, Valerie C., Essentials of anatomy and physiology/Valerie C. Scanlon, Tina Sanders. — 5th ed. p. ; cm. 622 P.

## 19.3 Information resources

1. <http://moodle.bsmu.edu.ua/course/view.php?id=1629>
2. <http://moodle.bsmu.edu.ua/course/view.php?id=1075>

3. <http://lechebnik.info/447/>
4. <http://www.booksmed.com/fiziologiya/>
5. <http://www.studfiles.ru/preview/1784985/>
6. <https://www.zygotebody.com/>
7. <https://www.visiblebody.com/>
8. [https://www.bartleby.com/107/?fbclid=IwAR19tVFpimou2NEnd-agyDaZ1o76VSh7c67ci\\_fu8iJfUUM9vbmbLjDKsng](https://www.bartleby.com/107/?fbclid=IwAR19tVFpimou2NEnd-agyDaZ1o76VSh7c67ci_fu8iJfUUM9vbmbLjDKsng)
9. [https://www.healthline.com/human-body-maps?fbclid=IwAR1THpofcpVXBow8Ys8z8rKk1wScddAHnPfPbgq6xENIPq0f\\_XlxCRKreyo](https://www.healthline.com/human-body-maps?fbclid=IwAR1THpofcpVXBow8Ys8z8rKk1wScddAHnPfPbgq6xENIPq0f_XlxCRKreyo)
10. <http://www.curehunter.com/public/dictionary.do?fbclid=IwAR2PKYJDke8wGy6jKcYSESI6r9LWhtXWRg5uPIF45aZ4a4BFWK0d7fKpbg8>
11. <http://anatom.in.ua>
12. <http://biph.kiev.ua/uk/UPhSNews>
13. <http://www.physiologyinfo.org/mm/What-is-Physiology>
14. <http://www.medicalnewstoday.com/articles/248791.php>
15. <http://www.physoc.org/>
16. <http://medtropolis.com/your-health/>
17. <http://www.physiologyweb.com/>
18. <http://www.teachpe.com/anatomy/>

## **20. COMPILERS OF THE STUDENT HANDBOOK (SYLLABUS)**

1. Yasinska Olena Viktorivna - Associate Professor of Department of physiology named after Ya.D. Kirshenblat, PHD of Medical Sciences, Associate Professor
2. Bukataru Yuliana Serhiivna - Assistant of Department of physiology named after Ya.D. Kirshenblat, PHD of Pharmaceutical Sciences