

**AL-FARABI KAZAKH NATIONAL UNIVERSITY**  
**Medicine and Health Care Faculty**  
**Higher School of Medicine**  
**Department of Fundamental Medicine**

**Final exam program of**  
**MiF1206 Morphology and human physiology (4 credits)**

**Autumn semester 2022 academic year**

**Approved Form of the Final Exam - 2 Stage Exam:**  
**Stage 1 - Standard Written Exam,**  
**Stage 2 - Objective Structured Practical Exam (OSPE)**

**Topics for the final exam**

1. Anatomical Position. Anatomical Planes. Directional Terms. Major Body Regions (Axial and Appendicular Region) Body Cavities and Membranes. Organ Systems
2. The Structure and functions of the skin. Structure and functions of the Cutaneous Glands, dermal circulation;
3. Bone Development. Physiology of Osseous Tissue. Bone Disorders
4. Cranial Bones. Facial Bones
5. General Features of the Vertebral Column. General Structure of a Vertebra. Intervertebral Discs. Regional Characteristics of Vertebrae. Thoracic Cage
6. The Upper Limb and Lower Limb
7. The Pelvic Girdle. The Lower Limb
8. Joints and Their Classification; Jaw and knee joints.
  1. The Functions of Muscles; General Aspects of Muscle Anatomy.
  2. Physiology of Skeletal Muscle, Cardiac muscle and smooth muscle.
  3. Introduction, Blood Types. Erythrocytes. Leukocytes.
  4. Platelets and Hemostasis, The Control of Bleeding.
  5. Overview of the Cardiovascular System. Gross Anatomy of the heart
  6. Cardiac Muscle and the Cardiac Conduction System; Electrical and Contractile Activity of the Heart.
  7. Cardiac cycle and heart sound; Cardiac output
  8. General Anatomy of the Blood Vessels; Capillary Exchange; Physiology of Circulation
  9. Circulatory Routes and Blood Vessels of Axial and Appendicular Region
  10. The lymphatic and immune system.
  11. General Anatomy of the Respiratory System
  12. Pulmonary Ventilation
  13. Gas Exchange and Transport
  14. Anatomy and functions of the Urinary System
  15. Urine Formation I: Glomerular Filtration, Tubular Reabsorption and Secretion Water Conservation
  16. Fluid, Electrolyte and Acid Base Balance
  17. Nutrition; Metabolic States and Metabolic Rate
  18. General Anatomy and Digestive Processes; The Mouth Through Esophagus; The Stomach; The Liver, Gallbladder, and Pancreas; The Small Intestine and Large Intestine
  19. Chemical Digestion and Absorption
  20. Overview of the Nervous System; The basic structure and Physiology of Neurons.\

21. The Spinal Cord ; The Spinal nerves; Somatic Reflexes
22. Overview of the brain. Principal Divisions of the Brain
23. Integrative functions of the brain;
24. The Cranial Nerves
25. The Autonomic Nervous System
26. Overview of the Endocrine System ; Hormones and Their Actions; The Hypothalamus and Pituitary Gland ;Other Endocrine Glands
27. Properties and Types of Sensory Receptors;The General Senses; The Chemical Senses organ
28. Male reproductive anatomy and physiology
29. Female reproductive anatomy and physiology

### **Learning outcomes**

Students on the final written and test exam must demonstrate in their responses the ability to:

- describe and identify the structural and organizational structure of internal organs, localize and describe, correctly using the appropriate terminology, on models, drugs and medical imaging materials, the typical structure of internal organs and systems of human organs in the normal way, taking into account age, gender and individual characteristics;
- understand the functional organization of the human body at the systemic and organ level, the physiological processes of excitable tissues;
- explain the relationship of structure and function at the level of tissue, organs and organ systems, and the main physiological mechanisms for maintaining homeostasis, vital activity of the body and their features, taking into account age, gender and individual differences;
- integrate knowledge about the structure of the 12 organ systems at the systemic, organ levels and their phylogenetic development to understand anatomical and physiological features in different periods of normal development;

### **A rough typology of tasks for the exam**

#### **To pass the exam in writing**

<b>№</b>	<b>Lesson topics</b>	<b>Exam question</b>
<b>1</b>	<p><b>Introduction:</b></p> <ul style="list-style-type: none"> <li>- <i>Introduction to anatomy of physiology.</i></li> <li>- <i>Homeostasis, negative feedback, positive feedback,</i></li> <li>- <i>Anatomical position, Anatomical planes, directional terms. Main areas of the body (axial and appendicular region), body cavities and membranes, organ systems</i></li> </ul>	<p><i>Demonstrate the anatomical position.</i></p> <p><i>Describe the human body using directional and regional terms.</i></p> <p><i>Identify three planes, most commonly used in the study of anatomy</i></p> <p><i>Distinguish between the posterior (dorsal) and the anterior (ventral) body cavities, identifying their subdivisions and representative organs found in each</i></p> <p><i>Describe serous membrane and explain its function</i></p> <p><i>Define homeostasis and explain why this concept is central to physiology;</i></p> <p><i>Define negative feedback, give an example of it, and explain its importance to homeostasis;</i></p>

		<p><i>Define positive feedback and give examples of its beneficial and harmful effects</i></p> <p><i>Define gradient, describe the variety of gradients in human physiology, and identify some forms of matter and energy that flow down gradients</i></p>
2	<p><b>Integumentary system.</b></p> <ul style="list-style-type: none"> <li>- <i>Skin structure and function.</i></li> <li>- <i>General skin signs.</i></li> <li>- <i>The structure and function of the skin glands</i></li> </ul> <p><i>Skin blood circulation.</i></p>	<p><i>List the functions of the integumentary system and relate them to its structure;</i></p> <p><i>Describe the normal and abnormal colors that the skin can have, and explain their causes;</i></p> <p><i>Describe the common markings of the skin;</i></p> <p><i>Name two types of sweat glands, and relate the structure and function of each;</i></p> <p><i>Describe the location, structure, and function of sebaceous and ceruminous glands; Describe the role of dermal circulation;</i></p>
3	<p><b>Skeletal system:</b></p> <ul style="list-style-type: none"> <li>- <i>Bone Physiology;</i></li> <li>- <i>Bone development.</i></li> <li>- <i>Bones associated with the skull, cranial bones, facial bones.</i></li> <li>- <i>General features of the spine, general structure of the vertebra, intervertebral discs. Characteristics of the vertebrae.</i></li> <li>- <i>Pectoral girdle and upper limb.</i></li> <li>- <i>Pelvic girdle and lower limb..</i></li> </ul>	<p><i>List the functions of the skeletal system and relate them to its structure;</i></p> <p><i>Discuss the role of bones in regulating calcium and phosphate levels in the blood</i></p> <p><i>List the main hormones that regulate bone physiology, describe their action, describe the role of calcium in the skeletal system</i></p> <p><i>Describe two mechanisms of bone formation</i></p> <p><i>Describe the processes by which minerals are added to and removed from bone</i></p> <p><i>Explain why bone count varies by age and individual</i></p> <p><i>Describe the general characteristics of the spine and a typical vertebra;</i></p> <p><i>Describe the structure of the intervertebral discs and their connection with the vertebrae</i></p> <p><i>Identify the vertebrae in different areas of the spine</i></p> <p><i>Identify the sternum and ribs</i></p> <p><i>Identify the features of the clavicle, scapula, humerus, radius, ulna</i></p> <p><i>Describe the common features of tubular bone and flat bone</i></p> <p><i>Identify and describe the features of the pelvic girdle</i></p> <p><i>Compare the anatomy of the male and female pelvic girdles and explain the functional significance of the differences</i></p> <p><i>Identify and describe features of the femur, patella, shin bones, fibula, and foot bones</i></p>
4	<p><b>Joint:</b></p> <ul style="list-style-type: none"> <li>- <i>Joints and their classification.</i></li> <li>- <i>knee joints</i></li> </ul>	<p><i>Explain what joints are, how they are called and what functions they perform</i></p> <p><i>Name and describe the four main categories of joints</i></p>

<p><b>5</b></p>	<p><b>Muscle system:</b>  - <i>The Functions of Muscles,</i>  - <i>The Nerve-Muscle Relationship.</i>  <i>Behavior of Skeletal Muscle</i>  <i>Fibers</i></p>	<p><i>Describe the various functions of muscular system;</i>  <i>Describe the five physiological properties of all muscular tissue and their relevance to muscle function</i>  <i>Distinguish characteristics of skeletal muscle ,cardiac muscle and smooth muscle</i>  <i>Describe the structure of a neuromuscular junction and function of each of its component</i></p>
<p><b>6</b></p>	<p><b>Circulatory System: Blood</b>  - <i>Introduction, Blood Types.</i>  <i>Erythrocytes. Leukocytes.</i>  - <i>Platelets and Hemostasis, The Control of Bleeding.</i></p>	<p><i>Describe the functions and major components of the circulatory system;</i>  <i>Describe the components and physical properties of blood and Explain the significance of blood viscosity and osmolarity;</i>  <i>Explain what determines a person’s ABO and Rh blood types and how this relates to transfusion compatibility;</i>  <i>Describe the effects of a blood type incompatibility between mother and fetus</i>  <i>Describe the structure and function of erythrocytes (rbcs); Describe the structure and function of hemoglobin;</i>  <i>Name and describe the types, causes, and effects of erythrocyte excesses and deficiencies</i>  <i>Explain the function of leukocytes in general and the individual role of each leukocyte type;</i>  <i>Discuss the types, causes, and effects of leukocyte excesses and deficiencies.</i>  <i>Describe the body’s mechanisms for controlling bleeding and two reaction pathways that produce blood clots ;</i>  <i>List the functions of platelets; Explain what happens to blood clots when they are no longer needed;</i></p>

<p><b>7</b></p>	<p><b>Circulatory System: Heart</b>  - Overview of the Cardiovascular System. Gross Anatomy of the heart  - Electrical and Contractile Activity of the Heart.  - Cardiac Muscle and the Cardiac Conduction System. Blood flow, heart sounds and cardiac cycle  - Cardiac Output.</p>	<p><i>Describe the general location, size, and shape of the heart;</i>  <i>Describe the pericardial sac that encloses the heart.</i>  <i>Describe the three layers of the heart wall;</i>  <i>Identify the four chambers and four valves of the heart, the coronary arteries and their main branches, the major veins that drain the myocardium;</i>  <i>Identify the surface features of the sac heart and correlate them with its internal four-chambered anatomy;</i>  <i>Trace the flow of blood through the four chambers and valves of the heart and adjacent blood vessels;</i>  <i>Describe the components of the cardiac conduction system and the path traveled by electrical signals through the heart;</i>  <i>Definition of cardiac cycle, and the name and explain its four phases</i>  <i>Definition cardiac output (CO); Explain the mechanisms by which sympathetic and parasympathetic nerves raise and lower the heart rate, including the neurotransmitters, receptors, and ions involved</i></p>
<p><b>8</b></p>	<p><b>Circulatory System: Vessels</b>  - Cardiovascular system. General features of the CVS. Blood vessels. Arteries and veins.  Microcirculation stream.  Arterioles. Capillaries. Venules.  - General Anatomy of the Blood Vessels  - Cardiovascular system. Cardiac Muscle muscle tissue. Heart.  Layers of the Heart Wall.  - Blood pressure, resistance and flow  - Capillary Exchange. Regulation of blood pressure and flow.  - Venous Return and Circulatory Shock. Special Circulatory Routes.  Anatomy of the Pulmonary Circuit.  - Systemic Vessels of the Axial Region  - Anatomy of the Systemic Vessels of the Appendicular Region  - Anatomy of the Systemic Vessels of the Appendicular Region.</p>	<p><i>Define and distinguish between the pulmonary circuit and systemic circuit from blood pressure, capillary exchange, relative oxygenation of arterial and venous blood, and the vasomotor response to hypoxia</i>  <i>Identify the principal systemic arteries and veins of the axial and appendicular region. Trace the flow of blood from the heart to any major organ of the axial and appendicular region and back to the heart.</i>  <i>Explain How blood flow is related to resistance and pressure differences; the mathematical expression of these relationships</i>  <i>List variables that determine blood pressure and variables that determine peripheral resistance; whether each one is directly or inversely proportional to resistance; and which of them is most changeable from moment to moment</i>  <i>Explain three levels of control over blood pressure and flow</i>  <i>Describe mechanisms of action by angiotensin II, aldosterone, natriuretic peptides, antidiuretic hormone, epinephrine, and norepinephrine on blood pressure</i>  <i>Explain the meaning of capillary exchange and related mechanisms</i>  <i>Explain venous return and related mechanisms</i>  <i>Distinguish arteries, veins, and capillaries</i>  <i>Classify arteries, veins, and capillaries and describe their structures and functions.</i></p>

9	<p><b>The lymphatic and immune system:</b></p> <ul style="list-style-type: none"> <li>- Lymphoid system. General features of the Lymphoid system.</li> <li>Thymus. Lymphoid system.</li> <li>Lymph Nodes. Spleen.</li> <li>The lymphatic and immune system.</li> </ul>	<p>List the functions of the lymphatic system and relate to the structures;</p> <p>Explain how lymph forms and returns to the bloodstream;</p> <p>Name the major cells of the lymphatic system and state their functions;</p> <p>Describe the structure and function of the red bone marrow, thymus, lymph nodes, tonsils, and spleen</p> <p>Describe the characteristics of lymphatic capillaries that allow cells and other large particles to enter the lymph</p>
10	<p><b>The Respiratory system</b></p> <ul style="list-style-type: none"> <li>- General Anatomy and physiology of the Respiratory System</li> <li>- Pulmonary ventilation</li> <li>Gass exchange</li> </ul>	<p>List the functions of the respiratory system; Name and describe the organs of respiratory system; Relate the function of any portion of the respiratory tract to its gross and microscopic anatomy</p> <p>Identify the main structures and Trace the flow of air from the nose to the pulmonary alveoli;</p> <p>Identify the sources of resistance to airflow and discuss their relevance to respiration;</p> <p>Explain the significance of anatomical dead space to alveolar ventilation;</p> <p>Define the clinical measurements of pulmonary volume and capacity;</p> <p>Define terms for various deviations from the normal pattern of breathing.</p> <p>Define partial pressure and discuss its relationship to a gas mixture such as air;</p> <p>Contrast the composition of inspired and alveolar air; discuss how partial pressure affects gas transport by the blood;</p> <p>Describe the mechanisms of transporting O<sub>2</sub> and CO<sub>2</sub>;</p> <p>Describe the factors that govern gas exchange in the lungs and systemic capillaries; 11.Explain how gas exchange is adjusted to the metabolic needs of different tissues;</p>
11	<p><b>The Urinary System</b></p> <ul style="list-style-type: none"> <li>- Functions of the Urinary System.</li> <li>- Anatomy of the Kidney</li> <li>- Urine Formation I: Glomerular Filtration.</li> <li>- Urine Formation II: Tubular Reabsorption and Secretion.</li> <li>Water concentration</li> </ul>	<p>Name and locate the organs of the urinary system;</p> <p>List several functions of the kidneys in addition to urine formation;</p> <p>Describe the location and general appearance of the kidneys; Identify the external and internal features of the kidney;</p> <p>Trace the flow of blood through the kidney;</p> <p>Explain Four basic stages of urine formation and related mechanism regulated each .</p> <p>Describe the nerve supply to the kidney.</p> <p>Describe the process by which the kidney filters the blood plasma, including the relevant cellular structure of the glomerulus;</p> <p>Explain the forces that promote and oppose filtration, and calculate the filtration pressure if given the magnitude of these forces;</p> <p>Describe how the renal tubules reabsorb useful solutes</p>

		<p><i>from the glomerular filtrate and return them to the blood;</i></p> <p><i>Describe how the tubules secrete solutes from the blood into the tubular fluid;</i></p> <p><i>Describe how the nephron regulates water excretion.</i></p> <p><i>Explain how the collecting duct and antidiuretic hormone regulate the volume and concentration of urine;</i></p> <p><i>Explain how the kidney maintains an osmotic gradient in the renal medulla that enables the collecting duct to function.</i></p>
12	<p><b>The digestive system</b></p> <ul style="list-style-type: none"> <li>- <i>General Anatomy and Digestive Processes</i></li> <li>- <i>The Mouth Through Esophagus</i></li> <li>- <i>The Stomach. The Liver, Gallbladder, and Pancreas.</i></li> <li>- <i>Small and large intestine, Nutrition and metabolism</i></li> </ul>	<p><i>List the functions and major physiological processes of the digestive system;</i></p> <p><i>Distinguish between mechanical and chemical digestion;</i></p> <p><i>Identify the basic chemical process that underlies all chemical digestion, Name the major substrates and products of this process;</i></p> <p><i>List and identify the regions of the digestive tract and the accessory organs of the digestive system;</i></p> <p><i>Describe the general nervous and chemical controls over digestive;</i></p> <p><i>Identify the gross anatomy of the digestive tract from the mouth through the large intestine and accessory organs;</i></p> <p><i>Describe the composition and functions of saliva;</i></p> <p><i>Describe the nervous control of salivation and swallowing.</i></p> <p><i>Describe the process and mechanism of Chemical Digestion and Absorption of Lipid ,protein and carbohydrate</i></p> <p><i>Describe Hormones and paracrine secretions that regulate gastrointestinal function; Explain how gastric activity is controlled; the regulatory mechanisms of the cephalic, gastric, and intestinal phases</i></p> <p><i>Explain how Digestive organs protected from its own acid and enzymes</i></p> <p><i>Describe some factors that regulate hunger and satiety;</i></p> <p><i>Define nutrient and list the six major categories of nutrients;</i></p> <p><i>Name the blood lipoproteins, state their functions, and describe how they differ from each other;</i></p> <p><i>Name the major vitamins and minerals required by the body and the general functions they serve.</i></p>
13	<p><b>Fluid, electrolyte and acid balance</b></p> <ul style="list-style-type: none"> <li>- <i>Fluid Balance</i></li> <li>- <i>Electrolyte Balance</i></li> <li>- <i>Acid Base Balance</i></li> </ul>	<p><i>Name the major fluid compartments;</i></p> <p><i>List the body's sources of water and routes of water loss;</i></p> <p><i>Describe mechanisms of regulating water intake and output;</i></p> <p><i>List the functions of sodium and potassium;</i></p> <p><i>Explain how electrolyte balance is regulated;</i></p> <p><i>Describe three ways the body regulates pH.</i></p>

<p><b>14</b></p>	<p><b>The Nervous system:</b></p> <ul style="list-style-type: none"> <li>- Overview of the Nervous System. Properties of Neurons. Synapses. Neural Integration. Spinal cord. Somatic reflexes.</li> <li>- Spinal Nerves</li> <li>- Overview of the meninges, ventricles, cerebrospinal fluid and blood supply. Midbrain. Hindbrain. Forebrain. Cranial Nerves</li> </ul>	<p><i>Identify the gross and microscopic structures of spinal cord in the model;</i></p> <p><i>Identify the innervation of the spinal cord's branch;</i></p> <p><i>State the three principal functions of the spinal cord;</i></p> <p><i>Trace the pathways followed by nerve signals traveling up and down the spinal cord.</i></p> <p><i>Describe the anatomy of nerves and ganglia in general;</i></p> <p><i>Describe the attachments of a spinal nerve to the spinal cord;</i></p> <p><i>Trace the branches of a spinal nerve distal to its attachments;</i></p> <p><i>Name the five plexuses of spinal nerves and describe their general anatomy; Name some major nerves that arise from each plexus;</i></p> <p><i>Explain the relationship of dermatomes the spinal nerves.</i></p> <p><i>Define reflex and explain how reflexes differ from other motor actions;</i></p> <p><i>Describe the general components of a typical reflex arc;</i></p> <p><i>Explain how the basic types of somatic reflexes function</i></p> <p><i>List the components of the hindbrain and midbrain and their functions and identify them;</i></p> <p><i>Describe the location and functions of the reticular formation.</i></p> <p><i>Name the three major components of the diencephalon and describe their locations and functions;</i></p> <p><i>Identify the five lobes of the cerebrum in the model and their functions; ;</i></p> <p><i>Name and numbers and classify the 12 pairs of cranial nerves, and their relationships to the brainstem and skull foramina</i></p>
<p><b>15</b></p>	<p><b>Sense organs</b></p> <ul style="list-style-type: none"> <li>- Properties and Types of Sensory Receptors</li> <li>- The General Senses;</li> <li>- The Chemical Senses -taste</li> </ul>	<p><i>Define receptor and sense organ;</i></p> <p><i>List the four kinds of information obtained from sensory receptors</i></p> <p><i>Describe how the nervous system encodes each type; outline three ways of classifying receptors.</i></p> <p><i>List several types of somatosensory receptors;</i></p> <p><i>Describe the projection pathways for the general senses;</i></p> <p><i>Explain the mechanisms of pain and the spinal blocking of pain signals;</i></p> <p><i>Explain how taste receptors are stimulated;</i></p>
<p><b>16</b></p>	<p><b>The Endocrine System</b></p> <ul style="list-style-type: none"> <li>- Overview of the Endocrine System .</li> <li>- The Hypothalamus and Pituitary Gland .</li> <li>- Other Endocrine Glands</li> </ul> <p><b>Hormones and Their Actions</b></p>	<p><i>Define hormone and endocrine system;</i></p> <p><i>Name and identify all organs of the endocrine system;</i></p> <p><i>Contrast endocrine with exocrine glands;</i></p> <p><i>Recognize the standard abbreviations for many hormones;</i></p> <p><i>Describe similarities and differences between the nervous and endocrine systems.</i></p> <p><i>Describe the structure and location of the Hypothalamus and Pituitary Gland and other endocrine glands;</i></p> <p><i>Name the hormones these endocrine glands produce, what stimulates their secretion, and their functions;</i></p>



<b>17</b>	<b>The Reproductive System</b> - Male reproductive anatomy and physiology . - Female reproductive anatomy and physiology .	<i>Identify the gross anatomy of male and female reproductive system; Enumerate the functions of the male and female reproductive systems; Distinguish between the gonads of the two sexes, and between the internal and external genitalia. Describe the structure and function of the glands and other ac-cessory organs of the female and male reproductive system; Discuss female and male sexual development from puberty through menopause.</i>
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### The list of anatomical structures

№	Topic	Anatomical structures
<b>1</b>	<b>Integumentary system</b>	Epidermis Dermis Subcutaneous tissue Apocrine sweat gland Merocrine sweat gland Touch receptor (Tactile corpuscle) Hair shaft Hair follicle Sebaceous (oil) gland Motor nerve fibers Lamellar corpuscle (pressure receptor) Sensory nerve fibers
<b>2</b>	<b>Skeletal System</b>	<b>Skull</b> supraorbital foramen / notch supraorbital margin glabella sella turcica optic canal superior orbital fissure foramen rotundum foramen ovale

	foramen spinosum
	foramen lacerum
	medial pterygoid plate
	lateral pterygoid plate
	coronal suture
	sagittal suture
	parietal foramen
	zygomatic process
	mandibular fossa
	mastoid process
	stylomastoid foramen
	internal auditory canal
	carotid canal
	jugular foramen
	foramen magnum
	basilar part
	occipital condyle
	hypoglossal canal
	condylar canal
	external occipital protuberance
	superior nuchal line
	inferior nuchal line
	orbital plate
	superior nasal concha
	middle nasal concha
	crista galli
	infraorbital foramen
	frontal process
	orbital surface
	alveolar process
	palatine process

	maxillary sinus
	mental tubercle
	foramen mentale
	condylar process
	coronoid process
	mandibular notch
	mandibular foramen
	angle of mandible
	mandibular ramus
	body of the hyoid bone
	greater horn
	lesser horn
	Perctoral girdle
	superior margin
	medial margin
	lateral margin
	inferior angle
	superior angle
	spine of the scapula
	supraspinatus fossa
	infraspinatus fossa
	scapular notch
	acromion
	coracoid process
	glenoid cavity
	subscapular fossa
	head of rib
	neck of rib
	costal tubercle
	costal groove
	conoid tubercle

	sternal end
	acromial end
	manubrium
	suprasternal (jugular) notch
	clavicular notch
	sternum body
	sternum angle
	xiphoid process
	<b>Pelvic girdle</b>
	iliac crest
	acetabulum
	superior anterior iliac spine
	iliac fossa
	superior ramus of the pubic bone
	inferior anterior iliac spine
	inferior branch of the pubic bone
	obturator foramen
	ischial ramus
	ischial spine
	large sciatic notch
	superior posterior iliac spine
	auricular surface
	inferior posterior iliac spine
	lesser ischial notch
	ischial tuberosity
	<b>Upper limb</b>
	anatomical neck
	Greater tubercle
	lesser tubercle
	intertubercular sulcus
	deltoid tuberosity

	head of humerus
	lateral epicondyle
	medial epicondyle
	lateral supracondylar crest
	medial supracondylar crest
	olecranon fossa
	radial fossa
	radial tuberosity
	styloid process
	trochlea
	olecranon
	coronoid process
	radial notch
	<b>Lower limb</b>
	fossa of the head
	greater trochanter
	lesser trochanter
	intertrochanteric crest
	intertrochanteric line
	linea aspera
	linea pectinea
	gluteal tuberosity
	medial supracondylar line
	lateral supracondylar line
	medial epicondyle
	lateral epicondyle
	medial condyle
	lateral condyle
	intercondylar fossa
	patellar surface
	popliteal surface

	lateral condyle
	medial condyle
	intercondylar eminence
	tibial tuberosity
	medial malleolus
	head of fibula
	apex of the fibula
	lateral malleolus
	scaphoid bone
	lunate bone
	triangular bone
	pisiform bone
	trapezoid bone
	trapezium bone
	capitate bone
	hamate bone
	metacarpal
	proximal phalanx
	distal phalanx
	middle phalanx
	calcaneus
	talus
	scaphoid bone
	medial sphenoid bone
	intermediate cuneiform bone
	lateral cuneiform bone
	cuboid bone
	<b>Vertebral column</b>
	dens
	foramen transversum
	superior articular facet

	inferior articular facet
	spinous process
	transverse process
	body of the vertebra
	anterior sacral foramen
	median sacral crest
	lateral sacral crest
	posterior sacral foramen
	auricular surface
	promotorium
	superior articular process
	Pedicle
	Lamina
	Vertebral arch
	Vertebral foramen
	Intervertebral disc
	Anterior tubercle
	Intervertebral foramen
	Posterior tubercle
	<b>Joints</b>
	Fibular collateral ligament
	tibial collateral ligament
	anterior cruciate ligament
	posterior cruciate ligament
	Medial meniscus
	Lateral meniscus
	Patellar ligament
	transverse knee ligament
	Sphenomandibular ligament
	Lateral ligament
	Joint capsule

		Stylomandibular ligament
		Synovial membrane
		Inferior joint cavity
		Articular disc
		Joint capsule
		Superior joint cavity
3	<b>Heart</b>	pericardial cavity
		parietal pericardium
		base of heart
		apex of heart
		superior vena cava
		inferior vena cava
		aortic arch
		pulmonary trunk
		pulmonary arteries
		aorta
		visceral pericardium
		endocardium
		myocardium
		right and left atria
		pectinate muscles
		auricle
		right and left ventricles
		interventricular septum
		fibrous rings (anuli fibrosi)
		coronary (atrioventricular) sulcus
		anterior interventricular sulcus
		posterior interventricular sulcus
		left atrioventricular (AV) valve
		right AV (tricuspid) valve
		papillary muscles



		aortic valve
		pulmonary valve
		tendinous cords (chordae tendineae)
		left coronary artery
		anterior interventricular branch
		circumflex branch
		left marginal branch
		right coronary artery
		right marginal branch
		posterior interventricular branch
		great cardiac vein
		posterior interventricular (middle cardiac) vein,
		left marginal vein
		coronary sinus
4	<b>Blood Vessels</b>	Arteries
		Veins
		Capillaries
		tunica interna (tunica intima)
		endothelium
		tunica media
		tunica externa (tunica adventitia)
		Conducting (elastic or large) arteries
		Distributing (muscular or medium) arteries
		arterioles
		Carotid sinuses
		Muscular venules
		Arteriovenous anastomosis
		superior lobar artery
		inferior lobar arteries
		ascending aorta
		aortic arch

	brachiocephalic trunk
	common carotid arteries
	left subclavian
	descending aorta
	vertebral arteries
	thyrocervical trunks
	costocervical trunks
	external carotid artery
	superior thyroid artery
	lingual artery
	occipital artery
	maxillary artery
	superficial temporal artery
	ophthalmic artery
	anterior cerebral artery
	middle cerebral artery
	basilar artery
	posterior cerebral arteries
	anterior cerebral arteries
	anterior communicating artery
	posterior communicating arteries
	dural venous sinuses
	superior sagittal sinus
	inferior sagittal sinus
	transverse sinuses
	cavernous sinuses
	internal jugular vein
	facial vein
	external jugular vein
	vertebral vein
	aortic hiatus

	Bronchial arteries
	Esophageal arteries.
	Mediastinal arteries
	Posterior intercostal arteries
	Subcostal arteries
	Superior phrenic arteries
	internal thoracic artery
	pericardiophrenic artery
	anterior intercostal arteries
	thoracoacromial trunk
	subscapular artery
	subclavian vein
	brachiocephalic vein
	superior vena cava
	azygos vein
	ascending lumbar vein
	hemiazygos vein
	inferior phrenic arteries
	superior suprarenal arteries
	celiac trunk
	superior mesenteric artery
	renal arteries
	ovarian arteries
	testicular arteries
	lumbar arteries
	median sacral artery
	common iliac arteries
	common hepatic artery
	gastroduodenal artery
	hepatic artery proper
	splenic artery

	left gastro-omental artery
	ileal arteries
	ileocolic artery
	middle colic artery
	sigmoid arteries
	superior rectal artery
	vaginal artery
	obturator artery
	internal pudendal artery
	superior vesical artery
	uterine artery
	iliolumbar artery
	superior gluteal artery
	inferior vena cava
	common iliac veins
	lumbar veins
	ovarian veins
	testicular veins
	renal veins
	suprarenal vein
	hepatic veins
	ascending lumbar veins
	hepatic portal system
	inferior mesenteric vein
	splenic vein
	hepatic portal vein
	cystic vein
	subclavian artery
	axillary artery
	circumflex humeral arteries
	brachial artery

	radial collateral artery
	ulnar collateral artery
	radial artery
	ulnar artery
	interosseous arteries
	palmar arches
	dorsal venous network
	cephalic vein
	basilic vein
	median cubital vein
	median antebrachial vein
	venous palmar arches
	radial veins
	ulnar veins
	brachial veins
	axillary vein
	subclavian vein
	external iliac artery
	femoral artery
	deep femoral artery
	circumflex femoral arteries
	popliteal artery
	anterior tibial artery
	dorsal pedal artery
	arcuate artery
	posterior tibial artery
	lateral plantar arteries
	deep plantar arch
	fibular artery
	dorsal venous arch
	saphenous vein

		deep plantar venous arch
		fibular veins
		popliteal vein
		femoral vein
		common iliac vein
5	<b>Respiratory System</b>	Nasal cavity
		Hard palate
		Nostril
		Pharynx
		Larynx
		Trachea
		Pleural cavity
		Pleura
		Epiglottis
		Posterior nasal aperture
		Soft palate
		Esophagus
		Left lung
		Left main bronchus
		Lobar bronchus
		segmental bronchus
		Diaphragm
		Alar nasal sulcus
		Dorsum nasi
		Nasofacial angle
		Nasal septum
		Nasal bone
		Lateral cartilage
		Minor alar cartilages
		Major alar cartilages
		Septal nasal cartilage

	nasal fossae
	nasal conchae
	nasopharynx
	laryngopharynx
	oropharynx
	Frontal sinus
	Meatuses
	Vestibular fold
	Vocal cord
	Uvula
	Auditory tube
	Cribriform plate
	Vestibule
	Guard hairs
	Upper lip
	Perpendicular plate
	Septal cartilage
	Lingual tonsil
	Sphenoid sinus
	Hyoid bone
	Thyrohyoid ligamen
	Vomer
	Thyroid cartilage
	Laryngeal prominence
	Arytenoid cartilage
	Cricoid cartilage
	Cricotracheal ligament
	Cuneiform cartilage
	Corniculate cartilage
	Fat pad
	Tracheal cartilage

	Glottis
	Main bronchi
	Tracheal mucosa
	Lateral cricoarytenoid muscle
	Base of tongue
	Trachealis muscle
	Hyaline cartilage ring
	Mucosa
	Mucous gland
	Perichondrium
	Chondrocytes
	Goblet cell
	Ciliated cell
	Mucociliary escalator
	Apex of lung
	Superior lobar bronchus
	Horizontal fissure
	Middle lobar bronchus
	Middle lobe
	Inferior lobar bronchus
	Oblique fissure
	Inferior lobe
	Base of lung
	Mediastinal surfaces
	Costal surface
	Cardiac impression
	Diaphragmatic surface
	Visceral pleura
	Parietal pleura
	Pleural cavity
	Alveoli



		Bronchial smooth muscle
		Branches of pulmonary artery
		Bronchiole
		Alveolar sac
		Terminal bronchiol
		Respiratory bronchiole
		Capillary networks around alveoli
		Respiratory membrane
		Shared basement membrane
		Pontine respiratory group (PRG)
		Dorsal respiratory group (DRG)
		Ventral respiratory group (VRG)
6	<b>Urinary System</b>	kidneys
		ureters
		urinary bladder
		urethra
		hilum
		renal fascia
		perirenal fat capsule
		fibrous capsule
		renal sinus
		renal cortex
		renal medulla
		renal columns
		renal pyramids
		renal papilla
		minor calyx
		major calyx
		renal pelvis
		renal artery
		segmental arteries

	interlobar arteries
	arcuate arteries
	cortical radiate arteries
	afferent arterioles
	nephron
	glomerulus
	efferent arteriole
	peritubular capillaries
	cortical radiate veins
	arcuate veins
	interlobar veins
	renal vein
	vasa recta
	renal corpuscle
	glomerular capsule
	podocytes
	capsular space
	renal tubule
	proximal convoluted tubule
	nephron loop
	descending limb
	distal convoluted tubule
	collecting duct
	papillary duct
	juxtamedullary nephrons
	cortical nephron
	renal plexus
	juxtaglomerular apparatus
	detrusor
	external urethral orifice
	urethral glands

		internal urethral sphincter.
7	<b>Nervous system</b>	The medulla oblongata;
		the cerebellum;
		the midbrain;
		the diencephalon;
		the final brain;
		the hindbrain;
		the brain stem;
		the fourth ventricle;
		the roof of the fourth ventricle;
		superior cerebral sail;
		diamond-shaped fossa;
		the upper and lower legs of the cerebellum;
		the median groove;
		facial tubercle;
		triangles of the hyoid and vagus nerves;
		medial elevation;
		the vestibular field;
		brain strips;
		lateral pockets;
		the legs of the brain;
		the intersternal fossa, the posterior perforated substance;
		black substance;
		the roof of the midbrain;
		the base of the leg of the brain;
		water supply of the midbrain, central gray matter;
		the upper cerebellar legs;
		superior cerebral sail;
triangle triangle;		
the thalamus, its anterior tubercle and pillow;		
medial and upper surfaces, brain strips;		

	interthalamic fusion;
	triangles of leashes, leashes, adhesion of leashes;
	the pineal gland;
	medial and lateral cranked bodies;
	visual crossroads;
	optic tracts;
	gray tubercle, funnel, pituitary gland;
	mastoid bodies;
	the third ventricle;
	cervical thickening;
	lumbosacral thickening;
	brain cone;
	terminal thread;
	the front median gap;
	the posterior median sulcus;
	anterior lateral groove;
	posterior lateral groove;
	back intermediate furrow;
	front spine;
	back spine;
	spinal cord node;
	the spinal nerve;
	a segment of the spinal cord;
	the front horn;
	back horn;
	lateral horn;
	lateral intermediate substance, central intermediate substance;
	the central channel;
	the front cord;
	the back cord;
	lateral cord;

		own bundles (anterior, lateral, posterior);
		the posterior spinal cord pathway;
		the anterior spinal cord pathway;
		lateral spinothalamic pathway;
		lateral cortical-spinal (pyramidal) pathway;
		the red nucleus-spinal pathway;
		anterior spinothalamic pathway;
		anterior cortical-spinal (pyramidal) pathway;
		the roof of the spinal cord;
		the reticulo-spinal path;
		the hard membrane of the spinal cord;
		epidural space; arachnoid membrane;
		subarachnoid space;
		the soft membrane of the spinal cord;
		the gear ligament.
8	<b>Lymphatic system</b>	lymphatic organs primary and secondary
		Thymus
		lymphatic nodes
		spleen
		bone marrow
		lymphatic vessels
		lymphatic trunks
		lymphatic ducts
9	<b>Digestive system</b>	Oral cavity
		Parotid gland
		Tongue
		Teeth
		Sublingual gland
		Submandibular gland
		Esophagus
		Pharynx

	Pancreas
	Stomach
	Liver
	Gallbladder
	Bile duct
	Ascending colon
	Transverse colon
	Descending colon
	Sigmoid colon
	Rectum
	Anal canal
	Anus
	Cecum
	Appendix
	Greater omentum
	Lesser omentum
	Mesocolon
	Mesentery
	Vestibule
	Palatoglossal arch
	Palatopharyngeal arch
	Palatine tonsil
	Lingual frenulum
	Superior labial frenulum
	Uvula of soft palate
	Lingual tonsils
	Vallate papillae
	Epiglottis
	Central incisor
	Lateral incisor
	Canine

		premolar
		molar
		Fundic region
		Cardial part
		Gastric rugae
		Greater curvature
		Greater omentum
		Lesser omentum
		Lesser curvature
		Antrum
		Pyloric canal
		Pylorus
		Pyloric sphincter
		Hepatic portal vein
		Hepatic artery proper
		Bile duct
		Quadrate lobe
		Gallbladder
		Bare area
		Falciform ligament
		Cystic duct
		Hepatopancreatic sphincter
		Hepatopancreatic ampulla
10	<b>Endocrine system</b>	Pineal gland
		Hypothalamus
		Thyroid gland
		Thymus
		Adrenal gland
		Parathyroid glands
		Pancreas
		Pituitary gland

		Testis
		Ovary
11	<b>Reproductive system</b>	Prepuce
		Glans
		Median septum of scrotum
		Cremaster
		Dartos
		Spermatic cord
		Testicular artery
		Ductus deferens
		Pampiniform plexus
		Epididymis
		Tunica vaginalis
		Testis
		Efferent ductule
		Rete testis
		Ampulla
		Seminal vesicle
		Ejaculatory duct
		Prostate
		Bulbourethral gland
		Bulbospongiosus muscle
		Membranous urethra
		Deep artery
		Tunica albuginea
		Median septum
		Lacunae
		Dorsal vein
		Dorsal artery
		Dorsal nerve
		Corpus spongiosum



	Corpus cavernosum
	Spongy (penile) urethra
	Corpus spongiosum
	Prostatic urethra
	Frenulum
	External urethral orifice
	Pubic symphysis
	Mons
	Corpus cavernosum Deep fascia
	Superficial fascia Skin
	Round ligament Uterus
	Urinary bladder
	Clitoris
	Labium majus
	Labium minus
	Round ligament
	Uterine tube Fimbriae
	Ovary
	Cervix of uterus
	Vaginal orifice
	Fimbriae
	Perimetrium
	Myometrium
	Endometrium
	Infundibulum
	Ampulla
	Isthmus
	Infundibulum
	Fimbriae
	Vagina
	Ovarian ligament

### Example of physiology assignment:

- 1) Describe the importance of the viscosity and osmolarity of blood, what accounts for each, and the pathological effects of abnormal viscosity or osmolarity. Describe excesses and deficiencies in RBC count and the forms, causes, and pathological consequences of each
- 2) Describe mechanisms of presynaptic facilitation and inhibition, and how communication between two neurons can be strengthened or weakened by a third neuron employing one of these mechanisms. Explain the cellular basis of memory; what memory consists of in terms of neural pathways, and how it relates to synaptic plasticity and potentiation

### Example of an OSPE stations

At each station it is necessary to fill in the gaps in accordance with the table.  
Determine the structure of the body proposed to you and write them in Russian and Latin

#### 4 Station – Spinal cord

№	English	Latin
№ 77 model		
		substantia grisea
	white matter	
		dura mater
	Pia mater	
7		

#### Response quality scale (written / oral response)

Mark	Criteria	Scale, points
Excellent	<ol style="list-style-type: none"> <li>1. all key aspects are included and presented logically;</li> <li>2. high accuracy (relevance, without redundancy) and constant attention to the issue;</li> <li>3. excellent integration of theoretical questions;</li> <li>4. providing relevant examples;</li> <li>5. in-depth analysis and theoretical justification of the problem (if applicable), all key aspects identified and interpreted;</li> <li>6. fluency in professional terminology</li> </ol>	90 - 100

Good	<ol style="list-style-type: none"> <li>1. all key aspects are included and presented logically;</li> <li>2. constant focus on the issue with satisfactory accuracy, relevance, and / or some redundancy;</li> <li>3. satisfactory integration of theoretical questions;</li> <li>4. the lack of examples;</li> <li>5. satisfactory analysis and theoretical justification of the problem (if applicable), most of the key aspects identified and interpreted;</li> <li>6. correct use of professional terminology</li> </ol>	70 - 89
Satisfactory	<ol style="list-style-type: none"> <li>1. most of the key aspects are included;</li> <li>2. satisfactory focus on the question - some errors and / or noticeable redundancy;</li> <li>3. theoretical problems presented without noticeable integration;</li> <li>4. Providing failed examples or no examples;</li> <li>5. some analysis and theoretical justification of this problem (if applicable), most of the key aspects are defined and interpreted;</li> <li>6. correct use of professional terminology</li> </ol>	50 - 69
Unsatisfactory (FX)	<ol style="list-style-type: none"> <li>1. most of the key aspects are omitted;</li> <li>2. lack of attention to the issue-irrelevant and significant redundancy;</li> <li>3. some theoretical problems presented without integration and understanding;</li> <li>4. missing or outdated examples;</li> <li>5. some analysis and theoretical justification of this problem (if applicable), most of the key aspects are omitted;</li> <li>6. problems in using professional terminology</li> </ol>	25 - 49
Unsatisfactory (F)	<ol style="list-style-type: none"> <li>1. most or all of the key aspects are omitted;</li> <li>2. no focus on the question, not much related to the issue of information;</li> <li>3. significant gaps in theoretical questions, or their superficial consideration;</li> <li>4. the lack of examples or irrelevant examples;</li> <li>5. there is no analysis and no theoretical justification for the given problem (if applicable), most of the key aspects are omitted;</li> <li>6. problems in using professional terminology</li> </ol>	0-24

### Grading system

Rating by letter system	Digital equivalent of points	Percentage	Evaluation using the traditional system
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A	4	95-100	Excellent
A-	3,67	90-94	
B+	3,33	85-89	Good
B	3	80-84	
B-	2,67	75-79	
C+	2,33	70-74	
C	2	65-69	
C-	1,67	60-64	Satisfactory
D+	1,33	55-59	
D-	1	50-54	
FX	0	25-49	
F	0	0-24	Unsatisfactory
I (Incomplete)	-	-	«Discipline is not completed» (it is not taken into account when calculating the GPA)

### WRITTEN EXAM:

#### TRADITIONAL - ANSWERS TO QUESTIONS.

The process of taking a written exam by the student involves the automatic creation of an exam ticket for the student, to which you must form a written answer by direct handwriting.

#### Exam Technology Instructions

1. The duration of the exam is exactly 2 hours.
2. Written exams are administered according to the approved schedule.
3. Students may enter the auditorium where the written exam is administered only with an ID card (Passport or student ID card). The presence of persons not participating in the examination procedure is prohibited.
4. The proctor reconciles the identification document with the admission permission slip. A student who has a discipline clearance rating of less than 50% is not allowed to take the written exam.
5. The proctor (calls the names from the list and sits them down according to the list) starts them in the auditorium.

6. Late students are not allowed to take the exam.
7. Proctor gives each student an answer sheet (if necessary, the student may take an additional answer sheet) and gives the student the opportunity to choose a ticket for the discipline being passed (the text of the ticket should not be visible to the student).
8. Students present at the exam must sign the admission form.
9. The start and end times of the written exam are recorded on the blackboard.
10. During the written exam, students' questions on the content of the examination tickets are not considered.
11. If the student does not comply with the established requirements at the exam: uses crib notes, mobile and other devices, allows disciplinary violations, disturbs other students with their actions, the proctor has the right to remove student from the audience. In this case, an act of violation of the examination procedure is drawn up, the answer sheet is annulled by crossing out diagonally, the mark "Removed for violation" is made in the admission sheet, "0" points will be given in the sheet.
12. it is allowed for a student to visit the restroom no more than 1 time per hour, lasting no more than 5 minutes. If frequent visits to the restroom are required (for example, due to health conditions), the student must undergo a medical examination, and the exam is counted as the student's absence from the exam.
13. At the end of the exam, the student must turn in his/her ticket and answer sheet.

### **Stage 2 - Objective Structured Practical Exam (OSPE) Exam Technology Instructions**

1. The duration of the exam is exactly 60 minutes. There will be 6 stations in total, 10 minutes each. At the end of the time, a signal is emitted, students change stations in hourly order.
2. Written examinations are held according to the approved schedule.
3. Students are only allowed to enter the auditorium where the OSPE is held with an identity document (or student ID). The presence of persons not participating in the examination procedure is prohibited.
4. The proctor checks the identity document with the list of admission to the exam. A student with a rating-tolerance in the discipline of less than 50% is not allowed to take the written exam.
5. The launch to the audience is carried out by the proctor (calling names according to the list and seating them according to the list).
6. Late students are not allowed to take the exam.
7. The proctor gives each student a check sheet.
8. Students present at the exam must sign the admission sheet.
9. The start and end times of the written exam are recorded on the blackboard.
10. During the exam, students' questions on the content of checklists are not considered.
11. If a student does not comply with the established requirements for the exam: uses cheat sheets, mobile and other devices, commits disciplinary violations, interferes with other students with his actions, the proctor has the right to remove him from the audience. In this case, an act is drawn up on a violation of the exam procedure, the answer sheet is canceled by crossing out diagonally, the mark "Deleted for violation" is made in the admission sheet, and "0" is affixed to the sheet.
12. Upon completion of the exam, the student must return his checklist.

**Basic literature:**

1. Saladin, Kenneth S: Essentials of Anatomy & Physiology. (2018, McGraw-Hill Education)
2. Costanzo, Linda S.: BRS Physiology. Board Review Series.7 edition. -Wolters Kluwer Health, 2018.- 307p. - ISBN 1496367693, 9781496367693
3. Leslie P. Gartner: Color Atlas and Text of Histology. - 7th Edition. - Wolters Kluwer, 2017. ISBN 1496346734, 9781496346735
4. Russell K. Hobbie, Bradley J. Roth: Intermediate Physics for Medicine and Biology. - Springer, 2015. - ISBN 3319126822, 9783319126821
5. Andersson D, Medical Terminology: The Best and Most Effective Way to Memorize, Pronounce and Understand Medical Terms: Second Edition, ISBN-13 : 978-1519066626, 2016

**Additional literature:**

6. Standring, Susan: Gray's Anatomy: The Anatomical Basis of Clinical Practice. - 41 Elsevier Limited, 2016
7. Elaine N. Marieb, Lori A. Smith: Human Anatomy & Physiology Laboratory Manual, Main Version. - 11 edition. - Pearson Education,2015. - ISBN 9780133999143
8. Scanlon V. C, Essentials of Anatomy and Physiology 8th Edition, F.A. Davis Company, 2018
9. Victor P. Eroschenko, Atlas of Histology with Functional Correlations 13th Edition, LWW, 2017
10. William Bialek: Biophysics: Searching for Principles. -Princeton University Press, 2012. - ISBN 0691138915, 9780691138916

**Online resources:**

<https://app.lecturio.com/#/>

<https://3d4medical.com/>

[https://www.youtube.com/channel/UCc\\_I2c2bUtO0p4DVeo6-Kxg](https://www.youtube.com/channel/UCc_I2c2bUtO0p4DVeo6-Kxg)

<https://sites.google.com/a/umich.edu/bluelink/curricula/anatomy-403?authuser=0>