MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

STEPAN GZHYTSKYI NATIONAL UNIVERSITY OF VETERINARY MEDICINE AND BIOTECHNOLOGIES LVIV

Faculty of Veterinary Medicine

Department of Normal and Pathological Physiology named after S. V. Stoianovskiy

APPROVMENT
Dean of the Faculty of Veterinary Medicine
Stronskiy Yu.S.
"23" 06 2021

STUDYING PROGRAM OF THE EDUCATIONAL DISCIPLINE

ОК 14 «ANIMAL PHYSIOLOGY»

Educational Level Second

Branch of knowledge 21 «Veterinary Medicine»

Specialty 221 «Veterinary Medicine»

Kind of discipline Mandatory

Lviv 2021

Studying program of the educational discipline «Animal Physiology» for foreign students of the second educational level of the speciality 221 «Veterinary medicine», branch of knowledge 21 «Veterinary Medicine».

Developer:
Associated Professor of Department of Normal and
Pathological Physiology named after S.V. Stoianovskiy,
PhD _____ I.A. Kolomiiets

The studying program has been read and approved at the meeting of department of Normal and Pathological Physiology named after S.V. Stoianovskiy

protocol № 12 from «18» 05 2021

Head of the Department of Normal and
Pathological Physiology named after S.V. Stoianovskiy
doctor of veterinary medicine _____ I.I. Kovalchuk

Agreed by the Commission for the Protection of Vertebrate
Animals used for Experimental and Other Scientific Purposes
protocol № 10 from «13» 06 2021

Head of commission, Professor _____ A.R. Mysak

Agreed by the Educational and Methodological Commission
of the Specialty 211 «Veterinary Medicine»
protocol № 6 from «21» травня 2021

Head of commission, Professor _____ A.M. Tybinka

Approved by the Decision of the educational-methodical
Commission of the Faculty of Veterinary Medicine
protocol № 6 from «21» травня 2021

Head of commission, Professor _____ A.M. Tybinka

Approved by the Scientific Council of
the Faculty of Veterinary Medicine
protocol № 3 from «16» 06 2021

2

1. DESCRIPTION OF THE COURSE

Name of indicators	Hours in general	
	Full time	**Extramural**
Number of credits / hours	9 / 270	–
Total hours of classroom work	144	–
including:		
• lectures, hours.	64	–
• practical classes, hours.	–	–
• laboratory work, hours.	80	–
seminars, hours	–	–
Total hours of individual work	126	–
Form of control	credit / exam	–

Note.
Percentage of student's classroom time:
for full-time education - 53%;
for extramural studies - .

2.The subject, purpose and objectives of the discipline

2.1. Subject, purpose of studying the discipline

«Animal physiology» is the science that studies the processes of life of the organism of different types of clinically healthy animals and their constituents (cells, subcellular structures, tissues, organs and organ systems) in unity and interconnection with the environment.

The subject of the course is the study of the life processes of the organism of clinically healthy different species of animals and their constituents (cells, subcellular structures, tissues, organs and organ systems) in unity and interconnection with the environment. It is the basic discipline in the system of education in the specialty «Veterinary Medicine», as it studies the functions of all organs and organ systems in clinically healthy different species of animals and birds.

The purpose of the course «Animal Physiology» is to give students theoretical and practical knowledge of the course of physiological processes in all organs and systems of organs in the organism of clinically healthy different species of animals and birds in the unity and relationship with the environment

The course «Animal Physiology» includes the following main sections: blood physiology, physiology of endocrine glands, physiology of muscles and nerves, physiology of the central nervous system, physiology of higher nervous activity, physiology of analyzers, physiology of circulation, physiology of breathing, physiology of breathing, physiology and energy, physiology of reproduction and lactation, physiology of selection. All of these sections are of direct theoretical and practical relevance for the future specialty of the Veterinary Doctor.

The study of the discipline «Animal Physiology» is based on structural-logical connection with knowledge of Animal anatomy, Bioorganic and analytical chemistry, Biophysics, Veterinary genetics, Cytology, histology, embryology, Organic chemistry, Biochemistry.

The acquired knowledge of the discipline «Animal Physiology»is the basis for the study of the following disciplines: Veterinary hygiene and sanitation, Veterinary microbiology and immunology, Biotechnology in veterinary medicine, Veterinary virology, Veterinary pathophysiology, Veterinary pharmacology, Clinical diagnostics, Animal welfare and ethology, Obstetrics, gynecology and reproduction of animals, Animal reproduction, Animal reproduction and infectious diseases, Veterinary toxicology, Veterinary clinical biochemistry.

2.2. Objectives of the discipline.

The study of discipline involves the formation of the necessary competencies for students:

general competencies **(GC):**

GC 1. Ability to abstract thinking, analysis and synthesis.
GC 2. Ability to search, process information with various sources.
GC 3. Ability to apply knowledge in practice situations.
GC 4. Knowledge and understanding of the subject area and understanding of the profession.
GC 7. Skills in the use of information and communication technologies.
GC 8. Ability to conduct research on the appropriate levels, make informed decisions, evaluate and to ensure the quality of work performed.
GC 9. Ability to communicate with non-specialists in their field (experts from other fields).
GC 10. Ability to work in an international context.
GC 11. Definiteness and persistence in relation to the set tasks and responsibilities.
GC 12. The desire to preserve the environment.

professional competencies **(PC):**

PC 1. Ability to understand and establish features structure and functioning of cells, tissues, organs, them systems and devices of the animal body.
PC 2. Ability to use tools, special devices, instruments, laboratory equipment and other technical means to carry out the necessary manipulations during the performance of professional activities.
PC 3. Ability to follow the rules of labor protection, asepsis and antiseptics during the implementation of professional activities.
PC 4. Ability to conduct clinical trials with the aim drawing conclusions about the condition of animals or diagnosis.
PC 7. Ability to organize, conduct and analyze laboratory and special diagnostic tests.
PC 11. Ability to have knowledge of biosafety, bioethics and animal welfare.

2.3. Results of program studying (RPS).

As a result of the study of the discipline «Animal Physiology» the student should be able to demonstrate the following learning outcomes:

RPS 1. Have knowledge of the structure of organs, their systems and devices and the whole organism in general on macro-, micro- and submicroscopic levels, know the function, topography, determine the species and age of the organs, their systems and devices under normal conditions and pathology.
RPS 2. Know the basic parameters of the structure of organ function and characteristics and purpose of technical devices that used to clarify these parameters.
RPS 3. Know the rules of safety, personal hygiene, asepsis and antiseptics.
RPS 4. Know the etiology and pathogenesis of diseases, analyze epizootic and ecological situation, conditions of detention, feeding and exploitation of animals, take them into account physiological condition, species, breed and individual features, know the ways and methods of clinical research.
RPS 5. Know the features of the structure of the animal body by norms and possible changes in the shape and structure of organs by pathology.

3. STRUCTURE OF THE EDUCATIONAL DISCIPLINE

3.1. Distribution of hours by chapters of discipline

Names of sections and topics	Number of hours					
	Full time					
	Total	including				
		lec	pr	lab	in	ind.
Chapter 1 Introduction to Animal Physiology	16	2	–	4	–	10
Chapter 2 Physiology of Excitable Tissues	24	6	–	6	–	12
Chapter 3 Physiology of the Central Nervous System	26	8	–	8	–	10
Chapter 4 Physiology of Higher Nervous Activity	18	4	–	4	–	10
Chapter 5 Physiology of Sense Organs	20	4	–	6	–	10
Chapter 6 Physiology of the Endocrine System	16	8	–	4	–	4
Chapter 7 Physiology of the Blood System	26	4	–	14	–	8
Chapter 8 Physiology of Cardiovascular System	26	6	–	10	–	10
Chapter 9 Physiology of the Respiratory System	16	4	–	4	–	8
Chapter 10 Nutrition and Metabolism	24	6	–	4	–	14
Chapter 11 Physiology of Digestion	28	8	–	8	–	12
Chapter 12 Physiology of Male and Female Reproduction and Lactation	22	2	–	6	–	14
Chapter 13 Physiology of the Urinary System	8	2	–	2	–	4
Together	**270**	**64**	–	**80**	–	**126**

3.2. LECTURES

№	The names of the topics and their summary	Num-ber of hours
		Full time
Chapter 1: Introduction to Animal Physiology		
1	Contents and objectives of discipline «Animal physiology». Subject of animal physiology. Methods of physiological research. Living organism and its contact with the environment. Nervous and humoral regulation of functions in the body. Continuance of life and pregnancy of animals, continuance of incubation of poultry eggs.	**2**
Chapter 2: Physiology of Excitable Tissues		
2	Physiological characteristics of excitable tissues, their common properties. Concept about irritant, classification of irritants. Description of tissue excitation and conditions of excitation. Bioelectric phenomena in the body. Classification of potentials. Hypothesis about the origin of resting potential. Changes in excitable tissues during excitation.	**2**
3	The law "Power of Time". Concept about rheobase, chronaxie, lability. Doctrine of parabiosis by H. E. Vvedensky. Classification of nerve fibres. Laws of conducting impulses along nerve fibers.	**2**
4	Mechanisms of muscle contraction. Stages of muscle contraction. Types of the muscle contraction. Work, power, fatigue of the muscle Skeletal muscle fibres. Functions and properties of skeletal muscle fibres. Smooth muscle fibres. Properties of smooth muscle fibres.	**2**
Chapter 3: Physiology of the Central Nervous System		
5	The evolution and general characteristic of organization of nervous systems. The functions of central nervous system (CNS). The leading role of CNS in regulatory processes of the body. Neuron as the structural unit of the CNS, classification of neurons. The theory of the neurons structure of CNS. The concept of synapses. The mechanism of conduction of excitation through chemical synapse. Neurotransmitters. Conduction and peculiarities of excitation through the neuromuscular synapse. Reflex - the basic act of nervous activity. Classification of reflexes. The reflex arc, its main elements, classification and functions.	**2**
6	The properties of nervous centers. Principles of coordination in the CNS. Spinal cord, structure and functions. Tracts of the Spinal Cord	**2**
7	Central Nervous System, subdivisions: the cerebrum. CNS, subdivisions: the cerebellum. CNS, subdivisions: the diencephalon. CNS, subdivisions: the brainstem.	**2**
8	The Autonomic Nervous System (ANS). Sympathetic Nervous System. Parasympathetic Nervous System. The ANS functions.	**2**
Chapter 4: Physiology of Higher Nervous Activity		
9	Structure of cerebral cortex. The conception of higher nervous activity.	**2**

	The ways of studying of higher nervous activity. Localization of functions in the cortex according to its structure. Conditioned and unconditioned reflexes: differences, classification. Rules for building conditioned reflexes.	
10	Mechanisms of conditioned reflex producing. Biological and economic importance of conditioned reflexes. Dynamic stereotype, its biological and economic significance. Types of inhibition of conditioned reflexes. The first and second signaling systems.Types of higher nervous activity, their relationship with farm animal performance.	**2**
Chapter 5: Physiology of Sense Organs		
11	General characteristics of sense organs, classification. Sensory receptors, classification. Sensation: somatosensation, visceral sensations. Chemical Senses (gustation (taste) and olfaction (smell). Features of structure and functions.	**2**
12	Vision. Features of structure and functions. Hearing (audition). Features of structure and functions. Equilibrium (vestibular sensations). Features of structure and functions.	**2**
Chapter 6: Physiology of the Endocrine System		
13	General characteristics of the endocrine glands. Classes of Hormones. Properties of hormones. Hormones and Their Receptors. Action mechanism of hormones. Negative and Positive Feedback Regulation.	**2**
14	The Hypothalamus and the pituitary gland (hypophysis) - connections, functions. The neurotransmitters of hypothalamic neurons. The pituitary gland (hypophysis), its Functions. Hormones of the adenohypophysis, their physiological effects. Hormones of the neurohypophysis, their physiological effects.	**2**
15	Hormones of the thyroid gland, their physiological effects. Physiology of the parathyroid glands. Characteristics of the adrenal glands in animals and birds. Hormones of the adrenal medulla of the adrenal gland, their physiological effects. Hormones of the adrenal cortex of the adrenal gland, their physiological effects.	**2**
16	The pancreas as endocrine gland, physiological effects of its hormones. The epiphysis cerebri (pineal gland), physiological effects of its hormones. The thymus, physiological effects of its hormones. The sex glands (gonads), physiological effects of its hormones.	**2**
Chapter 7: Physiology of the Blood System		
17	The concept of the blood system. The internal environment of the body (blood, interstitial fluid, lymph). The functions of blood. The composition of blood. The properties of blood, buffer systems. Regulation of Acid-Base Balance. Formed Elements of Blood: Erythrocytes. Forms of hemoglobin.	**2**
18	Formed Elements of Blood: Leukocytes. Functions of different types of leukocytes. T-, B-Lymphocytes function and Specific Immune Response. Differential White Blood Cell Counts. Formed Elements of Blood: Blood platelets (thrombocytes). Hemostasis and Coagulation.	**2**

Chapter 8: Physiology of Cardiovascular System		
19	The functions of cardiovascular system. Evolution of cardiovascular system. The structure of the heart. The function of the blood circulation: pulmonary & systemic circulations. The functional peculiarities of the heart muscle (myocardium). Electrical Activity of the Heart (The conductive system). The Cardiac Cycle.	**2**
20	The Cardiac sounds. Electrocardiography. Cardiac output. Regulation of Cardiac Output.	**2**
21	Function of blood vessels. The main principles and velocity of the the blood-stream along the vessels. Regulation of arterial blood pressure and blood volume. Lymphatic Vessels.	**2**
Chapter 9: Physiology of the Respiratory System		
22	Functions of the respiratory system. Structure and Functions of the Upper Respiratory Tract. Lungs and surfactant. Physiology of Respiration. Ventilation. Types and Respiratory (ventilatory) rate in different species of animals.	**2**
23	Inspired, Expired, Alveolar air composition. Gas Exchange in the Lungs. Gas Exchange in the Tissues. Gas Transport in Blood. Control of Ventilation.	**2**
Chapter 10: Nutrition and Metabolism		
24	Nutrition and metabolism. Essential nutrients. Metabolism. Absorptive State: Anabolism. Postabsorptive State: Catabolism. Protein metabolism, its regulation. Nitrogen balance, essential amino acids.	**2**
25	Carbohydrate metabolism, its regulation. Blood Glucose in Ruminants. Lipid metabolism, its regulation. Metabolism during fasting or starvation.	**2**
26	Energy Metabolism. Heat and energy balance. Heat Production. Chemical and physical thermoregulation. Energy Needs During Exercise.	**2**
Chapter 11: Physiology of Digestion		
27	Types of nutrition. Steps in Nutrition. Types of Digestion. Functions of the digestive system. Organization of the Digestive System. Gastrointestinal motility and its regulation. Digestive hormones. Pregastric Physiology. Organization of the Mouth. Prehension and Chewing in different animals. Salivary Glands. Salivary secretion in different animals and its control. Swallowing and its regulation. Vomiting and its regulation.	**2**
28	Gastric Physiology. Nonruminant Stomach. Gastric Glands and Secretions. Gastric juice. The regulation of gastric juice secretion. Gastric Motility. Ruminant Stomach. Ruminant Forestomach. Fermentative Digestion. Forestomach Motility. Reticular, or Esophageal, Groove.	**2**
29	Physiology of the Small Intestine. Small Intestine Secretions and Motility. Intestinal juice. Exocrine Pancreas. Pancreatic exocrine	**2**

	secretions and its control. Liver Digestive Functions. Secretion of Bile and its control. Breakdown into Nutrients: Protein, Fat, Carbohydrate digestion. Nutrient Absorption in the Small Intestine.	
Chapter 12: Physiology of Male and Female Reproduction and Lactation		
30	Physiology of Lactation. Composition of Milk. Milk Secretion. Lactogenesis. Galactogenesis.	**2**
31	Physiology of Lactation. Milk Ejection or Letdown. Colostrum. Cessation of Lactation.	
Chapter 13: Physiology of the Urinary System		
32	Overview of Function of the Kidneys. Stages (steps) of urine formation. Glomerular Filtration. Proximal Tubule Transport. Concentration and Dilution of Urine. Reabsorption. Role of the Loop of Henle and Collecting Duct Transport. Osmotic Regulation of Antidiuretic Hormone. Sodium, Potassium, and Aldosterone Urine Acidification. Functions of the bladder. Mechanism and regulation of urination. Composition and volume of urine of different animals.	**2**
Total hours		**64**

3.3. LABORATORY CLASSES

№	The names of the topics and their summary	Num-ber of hours
		Full time
Chapter 1: Introduction to Animal Physiology		
1	General Laboratory Safety Rules during practical classes. General Safety Tips for Working With Animals during practical classes. First Aid.	**2**
2	Fixation of laboratory animals, ways of fixing. Hystory: development of physiology. Contribution of scientists to the development of animals physiology.	**2**
Chapter 2: Physiology of Excitable Tissues		
3	Frog pith and preparation. A muscle-nerve preparation. Stages of muscle contraction. Types of the muscle contraction (the single and tetanic contraction).	**2**
4	Determination of the twitch subthreshold and the threshold response for skeletal muscle and its motor nerve. Determination of the maximal twitch response of the muscle.	**2**
5	Bioelectrical phenomena. The first experiment of Galvani. The second experiment of Galvani. Matteucci's secondary tetanus experiment. Excitability and nerve conduction. Dynamometry.	**2**
Chapter 3: Physiology of the Central Nervous System		
6	Reflex activity of the spinal cord. Frog Spinal Reflexes. Determine (by the process of elimination) which frog activities are controlled by the spinal cord, which are controlled by the brain, and which are controlled by neither.	**2**
7	Analysis of the reflex arc, its main elements. Determining the time of the spinal reflex according to Turck's method .	**2**
8	Irradiation of excitation in the spinal cord and in nerve centers. Summation of excitation. Determination of spinal cord fatigue.	**2**
9	The phenomenon of the central inhibition. Sechenov`s experiment (central inhibition). Inhibition in the CNS.	**2**
Chapter 4: Physiology of Higher Nervous Activity		
10	Methods, ways, points of creating of conditioned reflexes in laboratory animals.	**2**
11	Studying of different types of inhibition of conditioned reflexes. Sleep and hypnosis. Theories of sleep.	**2**
Chapter 5: Physiology of Sense Organs		
12	Determination of sharpness vision. Binocular vision. Determination of eye protection reflexes. Determination of blind spot, macula. Observation of blind spot, afteraction, mixing colors, accommodation.	**2**
13	Determination of sharpness and adaptation of olfaction. Determination of	**2**

	sharpness and adaptation of hearing. Determination of sharpness and adaptation of tasting.	
14	Determination of the spatial threshold tactile sensitivity of human skin.	**2**
Chapter 6: Physiology of the Endocrine System		
15	Effect of epinephrine (adrenaline) on the frog's eye cornea. Effect of epinephrine (adrenaline) and Pituitrin on the frog's skin.	**2**
16	Determination of the effects of epinephrine, acetylcholine, atropine, and pilocarpine on the frequency and amplitude of cardiac muscle contraction in the frog.	**2**
Chapter 7: Physiology of the Blood System		
17	The technique of blood collection in laboratory animals. Determination of blood composition. Getting of The formed elements and Plasma. Getting of Serum.	**2**
18	Determination of the hematocrit (packed cell volume). Determination of blood viscosity. Determination of blood pH.	**2**
19	Determination of osmotic resistance (fragility) of erythrocytes. Determination of different types of hemolysis. Determination of erythrocyte sedimentation rate (ESR).	**2**
20	Determination of hemoglobin in the blood. Counting the number of erythrocytes in the blood.	**2**
21	Determination of leukocytes in the blood. Counting the number of leukocytes in the blood.	**2**
22	Determination of leukocytes in the blood. Determination of differential white blood cell counts.	**2**
23	Determination of blood groups. Determination of blood clotting, hemophilia.	**2**
Chapter 8: Physiology of Cardiovascular System		
24	Determination of the cardiac cycle, the Work of the frogs Heart, automatism, atrial and ventricular systole and diastole in the frog heart. Determination of the effects of epinephrine, acetylcholine, atropine, and pilocarpine on the frequency and amplitude of cardiac muscle contraction in the frog.	**2**
25	Determination of the effect of increasing and decreasing the temperature of cardiac muscle on cardiac rate and contractility in the frog. Determination of the cardiac movements in the rabbit.	**2**
26	Determination of the cardiac sounds in the rabbit. Determination of the impulse of the heart in the rabbit. Determination of the arterial pulse in the rabbit. Determination of blood pressure.	**2**
27	Reflexes on the heart: Goltz's classic reflex in the frog, Dagnini-Aschner's oculocardiac reflex, Ortoclinostatic test.	**2**
28	Atrioventricular block induced by Stannius ligature in the frog heart. Movement of the blood in vessels of the frog leg under the microscope.	**2**
Chapter 9: Physiology of the Respiratory System		
29	Determination of ventilation. Model of lungs. Determination of the	**2**

	pulmonary sounds in the rabbit. Determination of types and respiratory (ventilatory) rate in different species of animals.	
30	Spirometry. Measuring lung capacity. Vital capacity of the lungs (tidal volume , inspiratory reserve volume, expiratory reserve volume).Total lung capacity.	**2**
Chapter 9: Nutrition and Metabolism		
31	Methods of studying of the metabolism and Energy.	**2**
32	Determination of body temperature in different species of animals. Its regulation.	**2**
Chapter 11: Physiology of Digestion		
33	Determination of saliva composition and properties. Effect of saliva enzymes on starch.	**2**
34	Protein digestion by enzymes of gastric juice. The effect of chymosin on the coagulation of milk. Investigation of the motor function of the stomach.	**2**
35	Investigation of the effect of trypsin on protein. The effect of lipase on fats.	**2**
36	Research on the composition and properties of bile. Effect of enteric juice enzymes on starch.	**2**
Chapter 12: Physiology of Male and Female Reproduction and Lactation		
37	Determination of milk density in the cow. Investigation of milk fat under the microscope.	**2**
38	Determination of acidity of diferrent types of milk.	**2**
39	Investigation of the physical properties of milk. Isolation of milk proteins.	**2**
Chapter 13: Physiology of the Urinary System		
40	Investigation of physicochemical properties of urine. Determination of acidity of urine. Determination of composition of urine of the rabbit.	**2**
Total hours		**80**

3.4. Individual Work

№	The names of the topics and their summary	Num-ber of hours
		Full time
Chapter 1: Introduction to Physiology		
1	Methods of physiological research. Homeostasis. Development and formation of physiology in the ancient period, the Middle Ages and the Renaissance. Formation of scientific physiology. Development of physiology in Ukraine. Cell, as a structural and functional unit of the animal body. Features of the structure and functions of the cell membrane, nucleus and various organoids of the animal cell.	**3**
Chapter 2: Physiology of Excitable Tissues		
2	Features of smooth muscle functions. Features of structure and properties of nerve fibers. Features of conducting excitation by nerve fibers. The influence of direct current on living tissues. The polar law. Physiological electron.	**4**
Chapter 3: Physiology of the Central Nervous System		
3	Features of structure and functions of autonomic (autonomic) nervous system. The sympathetic and parasympathetic parts of the autonomic (autonomic) nervous system. Their functional features. The role of different CNS departments in the regulation of the body's autonomic functions. Excitatory (depolarizing) and inhibitory (hyperpolarizing) synapses.	**4**
Chapter 4: Physiology of Higher Nervous Activity		
4	Ethology as the science of animal behavior. Forms of behavior of animals. The role of hereditary and acquired factors in the formation of behavior. Animal behavior in different environmental conditions. Impression, insight as a form of animal behavior. Stress as an adaptive mechanism of homeostasis recovery. Effect of stress on animal performance. Stress prevention.	**3**
Chapter 5: Physiology of Sense Organs		
5	Features of the structure and functions of the motor analyzer. Interreceptor analyzer. Interreceptors, their division, structure and functions. The role of interoreceptors in the activity of the cardiovascular, respiratory, digestive, excretory and motor systems. Interaction of analyzers. Animal skin structure. Animal skin functions. The composition, properties and values of sweat. Sweating regulation. The sebaceous glands, their value. Age, breed and individual skin changes. Hair growth and its regulation. The molt and its regulation.	**3**
Chapter 6: Physiology of the Endocrine System		
6	Tissue hormones. The relationship between the glands of the internal secretion. The use of hormones and hormonal drugs in livestock and veterinary medicine.	**1**

Chapter 7: Physiology of the Blood System		
7	The doctrine of blood groups. A brief history of blood transfusions. Basic requirements for blood transfusion. Groups of antigenic factors in domestic animals. Rhesus factor. Hemopoiesis and its regulation. Nervous and humoral regulation of hematopoietic processes. Species and age characteristics of the blood system in animals.	**2**
Chapter 8: Physiology of Cardiovascular System		
8	Methods of blood circulation research. Regulation of circulation (nervous and humoral). Features of circulation in the heart, lungs, liver, spleen and brain. Circulatory features in different physiological conditions of the body (muscular work, pregnancy, lactation). Age-specific features of the circulatory system. Lymph and its value. Lymph formation. Lymph nodes, their value. Lymphogenic substances. Factors that provide lymphatic circulation. Neurohumoral mechanisms of regulation of lymph circulation.	**3**
Chapter 9: Physiology of the Respiratory System		
9	Respiratory Center. The role of CO2 in the regulation of respiration. Respiratory regulation (reflex and humoral). Changing breathing in muscular work. The interrelation of breathing with blood circulation. Oxygen deficiency. Breathing in high and low atmospheric pressure. Influence of age, level of productivity and conditions of keeping of animals on breath. Features of the structure and functions of the respiratory system in the bird. The voice of animals.	**3**
Chapter 10: Nutrition and Metabolism		
10	Fat-soluble vitamins, classification and their function in animals. Water soluble vitamins, classification and their functions in animals. Macronutrients, their functions in the body of animals. Microelements, their functions in the body of animals. Regulation of mineral metabolism. The importance of water in animals, sources of water and its content in various tissues of the body. Regulation of water exchange. The role of the liver in metabolism.	**4**
Chapter 11: Physiology of Digestion		
11	Features of digestion in large intestines of domestic animals. Motor function of the large intestine. The mechanism of absorption in the digestive system of animals. Regulation of absorption processes in the digestive system of animals. The length of stay of the feed in the digestive canal of various species of domestic animals and poultry. Excretory function of the digestive canal. Fecal formation and bowel movements. Features of digestion in poultry.	**3**
Chapter 12: Physiology of Male and Female Reproduction and Lactation		
12	Sexual and physiological maturity. Spermatogenesis, secretion of accessory glands in male animals. Sperm, its composition and physico-chemical properties. The sexual cycle and its phases, the sexual season in animals. Growth and development of follicles. Ovulation. The formation of a yellow body. Sexual reflexes of males and females. Sexual behavior. Steaming as a difficult reflex act. Types of insemination. Movement and	**4**

	survival of sperm in the reproductive organs of females. Fertilization process, development of fertilized egg (zygote). Physiological bases of artificial insemination and transplantation of embryos into the recipient's uterus. Factors that impair reproductive function. Methods for regulating the reproductive function of animals by hormones. Pregnancy and its duration in different animal species. The process of childbirth, its regulation. Features of breeding birds. A capacitive udder system. The reflex of milk production and its inhibition. Physiological bases of machine milking and ways of its improvement. Influence of various factors on milk composition and ways of increasing milk productivity of animals.	
Chapter 13: Physiology of the Urinary System		
13	Functions of the bladder. Mechanism and regulation of urination. Features of urine composition and urination in birds. Excretory function of the digestive canal and lungs.	**2**
General		**38**
Preparation for training sessions and control activities		**88**
Total hours		**126**

5. Teaching Methods

The study of the subject «Animal Physiology» is carried out using the following methods:

- teaching of lecture material;
- use of educational visual material (tables, diagrams, stands, models, slides, etc.);
- use of computer programs, videos, movies;
- solving situational tasks;
- conducting research on the functions of individual organs and organ systems and evaluating the results obtained;
- laboratory tests of blood, urine, milk and evaluation of the results obtained;
- scientific research work;
- independent work of students.

The main types of training according to the curriculum are:

- lectures;
- laboratory work;
- independent student work outside the classroom (SMS).

The main purpose of the lecture course is the development of scientific medical thinking in students and its use for the evaluation of the clinical condition of the animal, increasing the theoretical level of knowledge of the functions of different organs and systems of organs of different species of domestic and other species of animals; to learn how to properly combine the results of generally clinical and complementary research methods, to think logically and to draw the right conclusions. Knowledge of Animal Physiology to be used to diagnose and provide medical assistance to various animal species.

Laboratory classes by the method of their organization are practical-oriented and include:

- study of the functions of different organs and systems in different species of animals;
- to learn to analyze the indicators found in the study of individual organs and systems (body temperature, pulse and respiratory rate, scar reduction, heart tones, blood pressure, etc.), the study of which is applicable in the clinical practice of a veterinarian.

Current knowledge control is conducted in laboratory classes according to the specific objectives of the current topic. The assimilation of each topic is monitored in the classroom (initial control - as the level of readiness for laboratory work and the final control of knowledge and skills acquired after conducting laboratory classes) through oral questioning or test control, solving situational tasks.

The final control of students' knowledge in Animal Physiology is carried out upon completion of the study material of all sections of the discipline during the exam session in the form of a semester exam. Final examination (examination) is allowed for students who have completed all types of work required by the curriculum.

6. Control Methods

Assessment of student learning results is carried out by conducting current and final (examination) control of knowledge of the program material of the discipline.

The day-to-day knowledge control is carried out in laboratory classes according to the specific objectives of the current topic in the form of an oral survey or written express control or computer-based testing.

All laboratory classes provide objective control of theoretical training and control of mastering practical skills in the form of oral questioning or test control, solving situational problems. Knowledge of the material is controlled in the laboratory (initial control - as the level of readiness for laboratory activities and final control of the knowledge and skills acquired after the laboratory class).

Assessment of the knowledge of the program material of the students' independent work, which is foreseen to be studied along with the classroom work, is carried out during the current control of knowledge of the topic at the relevant classroom session, as well as during the final (examination) control.

The final control of students' knowledge in Animal Physiology is carried out upon completion of the study material of all sections of the discipline during the exam session in the form of a semester exam. Final examination (examination) is allowed for students who have completed all types of work required by the curriculum.

7. Criteria of Students' Learning Results

Assessment of student learning results in «Animal Physiology» is carried out by conducting current and final (test and exam) knowledge control. Assessment of student learning outcomes in each semester is made in points, the maximum number of which is 100.

The study of program material in «Animal Physiology» will be conducted by students of the 2nd year of the Faculty of Veterinary Medicine during the 1st and 2nd semesters. In the 1^{st} semester of study «Animal Physiology» students complete the final control of knowledge in the form of credit.

Transition credits are distributed as follows:

50 (CC)+ 50 (C) = 100

50 (CC) – 50 maximum points from current control (CC) that student can get during semester;

50 (C) – 50 maximum points that student can get for the 2 colloquiums.

The current control (CC) of all the student's scores on running knowledge control is calculated with the following translation into points in the formula:

CC=(50×MAN)/5=10×MAN

MAM – mid arithmetic number of all marks that student can get during semester.

The results of credit of knowledge of program material in «Animal Physiology» are evaluated on a four-point scale ("5", "4", "3", "2").

Table 1

Criteria for credit of students' knowledge

Evaluation	Evaluation criteria
«5», «4», «3» Satisfactory 3	Fully possesses educational material, freely independently and reasonably teaches it during oral presentations and written answers, thoroughly and comprehensively discloses the content of theoretical questions and practical / computational tasks, using normative, obligatory and additional literature. He has sufficient knowledge of the teaching material, justifies it during oral speeches and written answers, mainly reveals the content of theoretical questions and practical tasks, using normative and obligatory literature. The student is able to identify the essential features of the studied through the operations of synthesis, analysis, identify cause and effect relationships that may have some insignificant errors, form conclusions and generalizations, freely operate facts and information. In general, he possesses the educational material, sets out its main content during oral presentations and written calculations, but without deep comprehensive analysis, substantiation and argumentation, while leaving some material inaccuracies and mistakes.
«2» Unsatisfactory	Does not fully possess the educational material. Fragmentally, superficially (without argumentation and rationale), he presents it during oral speeches and written calculations, does not sufficiently disclose the content of theoretical questions and practical problems, while allowing significant inaccuracies, correctly solved separate calculation / test problems. Haphazard separation of random features of the studied; inability to perform the simplest operations of analysis and synthesis; make generalizations, conclusions.

Based on the results of the semester control of knowledge, the student is credited / unaccounted for on the national scale, and the number of points scored on the ECTS scale (Table 3).

Students complete the study of «Animal Physiology» by conducting a final examination in the form of an exam.

The distribution of points for the final knowledge control (exam) for the disciplines that are completed by the EXAMINATION (including the «Animal Physiology») are as follows:

50 (CC)+ 50 (E) = 100

50 (CC) – 50 maximum points from current control (CC) that student can get during semester;

50 (E) – 50 maximum points that student can get during the exam.

Exam points are credited to the student for answering the exam ticket questions.

The following types of tasks will be used in the various exam tickets:

- programmatic questions of theoretical nature - aimed at revealing students' theoretical knowledge;

- practical program questions - aimed at identifying students' skills;
- test questions - focused on identifying the basic concepts of the discipline.

Each examination ticket (option) will have six theoretical and practical program questions, to which the student must provide written full answers and 20 test papers. Correct answers to the test tasks are scored by 1 point, and the results of written answers to questions of theoretical and practical nature are evaluated on a 4-point scale ("5", "4", "3", "2") according to the requirements of the student knowledge assessment criterion (Table 2). Therefore, the maximum number of points that can be scored by the student in the exam is 50.

At the end of the 2nd semester, the current control (CC) of all the student's scores on running knowledge control is calculated with the following translation into points in the formula:

$$\mathbf{CC=(50\times MAN)/5=10\times MAN}$$

MAN – mid arithmetic number of all marks that student can get during semester.

The students who do not have absences during the semester (2 points are added);

- ✓ for participation in university student Olympiads, scientific conferences (2 points added), at the inter-university level (5 points added);
- ✓ for other types of educational research points are added by the decision of the department.

Table 2

Criteria for current and examination assessment of students' knowledge

Evaluation	Evaluation criteria
5	Fully possesses educational material, freely independently and reasonably teaches it during oral presentations and written answers, thoroughly and comprehensively discloses the content of theoretical questions and practical / computational tasks, using normative, obligatory and additional literature. He solved all the tasks correctly. The student is able to identify the essential features of the studied through the operations of synthesis, analysis, identify cause and effect relationships, form conclusions and generalizations, freely operate facts and information.
4	He has sufficient knowledge of the teaching material, justifies it during oral speeches and written answers, mainly reveals the content of theoretical questions and practical tasks, using normative and obligatory literature. However, some questions are lacking in depth and argumentation, while some minor inaccuracies and minor errors are allowed. Correctly solved most of the test problems. The student is able to identify the essential features of the studied through the operations of synthesis, analysis, identify cause and effect relationships that may have some insignificant errors, form conclusions and generalizations, freely operate facts and information.
3	In general, he possesses the educational material, sets out its main content during oral presentations and written calculations, but without deep comprehensive analysis, substantiation and argumentation, while leaving

	some material inaccuracies and mistakes.
2	Does not fully possess the educational material. Fragmentally, superficially (without argumentation and rationale), he presents it during oral speeches and written calculations, does not sufficiently disclose the content of theoretical questions and practical problems, while allowing significant inaccuracies, correctly solved separate calculation / test problems. Haphazard separation of random features of the studied; inability to perform the simplest operations of analysis and synthesis; make generalizations, conclusions.

Each student score is matched by a national and ECTS score (Table 3).

Table 3

The scale of evaluation of student performance

100 points scale	**On a national scale**		**ECTS**
	Exam	**Credit**	
90 – 100	Excellent	Enrolled	A
82 – 89	Okay		B
74 – 81			C
64 - 73	Satisfactorily		D
60 - 63			E
35 - 59	Unsatisfactory (not counted) with the possibility of reassembly		FX
0 - 34	Unsatisfactory (not counted) with mandatory re-study of discipline		F

Students will get acquainted with the content of the course syllabus, the list of questions for the current and final (credit and examination) control of knowledge of the program material of the course not later than the second week of the beginning of the academic year.

Students who fail to fully complete the planned volume of study work, have not completed their missed labs and lectures are not allowed to take the final exam and exam.

8. Studying Literature

1. Stojanovskij V.G., Golovach P.I., Slepokura O.I., Kolotnickij V.A., Kolomiec I.A., Zmija M.M., Garmata L.S. Physiology of blood circulation. Methodical instructions for laboratory classes and independent work on "Animal Physiology" for students, the level of higher education " Magister " specialty 211 - "Veterinary Medicine". Lviv: Stepan Gzhytskyi National University of Veterinary Medicine and Biotechnologies Lviv, 2018. 38 p.

9. Stojanovskij V.G., Golovach P.I., Slepokura O.I., Kolotnickij VA., Kolomiec I.A., Zmija M.M., Garmata L.S. Physiology of respiration. Methodical instructions for laboratory classes and independent work on "Animal Physiology" for students, the level of higher education "Magister" specialty 211 - "Veterinary Medicine". Lviv: Stepan Gzhytskyi National University of Veterinary Medicine and Biotechnologies Lviv, 2018. 27 p.

10. Stojanovskij V.G., Golovach P.I., Zmija MM., Slepokura O.I., Kolotnickij V.A., Kolomiec I.A. Physiology of digestion. Methodical instructions for laboratory classes and independent work on "Animal Physiology" for students, the level of higher education " Magister " specialty 211 - "Veterinary Medicine". Lviv: Stepan Gzhytskyi National University of Veterinary Medicine and Biotechnologies Lviv, 2018. 31 p.

11. Stojanovskij V.G., Golovach P.I., Zmija M.M., Kolomiec I.A., Kamracka O.I., Mihur N.I Physiology of analyzers and shkiri. Methodical instructions for laboratory classes and independent work on "Animal Physiology" for students, the level of higher education "Magister" specialty 211 - "Veterinary Medicine". Lviv: Stepan Gzhytskyi National University of Veterinary Medicine and Biotechnologies Lviv, 2018. 31 p.

12. Kolomiec I.A., Stojanovsky V.G., Golovach P.I., Zmia M.M. Physiology of blood. Methodical instructions for laboratory classes and independent work on "Animal Physiology" for students, the level of higher education " Magister " specialty 211 - "Veterinary Medicine". Lviv: Stepan Gzhytskyi National University of Veterinary Medicine and Biotechnologies Lviv, 2020. 23 p.

9. Recommended Literature

Basic:

1. Dr.P.B.Reddy's. Text book of Animal Physiology. Book: 2015. 159 p.
2. Rowen D. Frandson, W. Lee Wilke, Anna Dee Fails. Anatomy and Physiology of Farm Animals. 2016. 536 p.
3. Richard W. Hill, Gordon A. Wyse, Amherst Margaret Anderson. Animal Physiology Third Edition: Printed in U.S.A. 2012. 985 p.
4. Floron C. Faries, Jr., DVM, MS. Anatomy & Physiology of Animals. 2013. 84 p.
5. Hafez B., Hafez E.S.E. Reproduction in Farm Animals. 7th ed. Baltimore, Lippincott: Williams & Wilkins, 2000. 150 p.
6. Pineda M.H. Veterinary Endrocrinology and Reproduction. 5th ed. Ames: Iowa State University Press, 2001. 450 p.
7. Pollard, T.D., and W.C. Earnshaw. Cell Biology. Philadelphia. 2004. 250 p.
8. Reece W.O. Functional Anatomy and Physiology of Domestic Animals. 3rd ed. Baltimore: Lippincott, Williams & Wilkins. 2005. 380 p.
9. Swenson M.J., W.O. Reece, eds. Dukes' Physiology of Domestic Animals. 11th ed. Ithaca, N.Y., Comstock Publishing Associates, 1993. 300 p.
10. Tortora G.J., B. Derrickson. Principles of Anatomy and Physiology. 11th ed. Hoboken, N.J., John Wiley & Sons. 2006. 266 p.

Auxiliary:

1.Bacha W.J. and L.M. Bacha. Color Atlas of Veterinary Histology. 2nd ed. Baltimore: Lippincott Williams & Wilkins, 2000. 149 p.

2.Berne R.M., and M.N. Levy. Principles of Physiology. 3rd ed. St. Louis: Mosby, 2000. 180 p.

3. Bertone J. and C.M. Brown. The 5-Minute Veterinary Consult Equine. Baltimore: Lippincott, Williams & Wilkins, 2001. 285 p.

4. Boron W.F. and E.L. Boulpaep. Medical Physiology. 2nd ed. Philadelphia: W.B. Saunders, 2009. 199 p.

5.Akers R.M., Denbow D.M. Anatomy and Physiology of Domestic Animals. USA: Wiley-Blackwell Publ., 2008. 624 p.

6.Ganong W.F. Review of Medical Physiology. New York: Lange medical Books McGraw-Hill, 2001. 732 p.

10. Information Resource

1. The physiological society. URL: https://www.physoc.org/explore-physiology/what-is-physiology
2. Physiology – Definition, Major and History | Biology Dictionary. URL: https://www.medicalnewstoday.com/articles/248791.php
3. Human body – Organs, Systems, Structure, Diagram, & Facts. URL: https://www.britannica.com/science/physiology
4. Animal physiology – Latest research and news. Nature. URL: https://www.nature.com/subjects/animal-physiology
5. Animal Physiologist: Job Description, Duties and Requirements. URL: https://study.com/directory/category/Biological_and_Biomedical_Sciences/Zoology/Animal_Physiology.html
6. OpenLearn Create – The Open University. URL: https://www.open.edu/openlearncreate/mod/oucontent/view.php?id=23856&printable=1
7. Animal Physiology – Oxford University Press. URL: https://global.oup.com/academic/category/science-and-mathematics/biological-sciences/zoology-and-animal-biology/animal-physiology/?cc=us&lang=en&
8. Journal of Animal Physiology and Animal Nutrition – Wiley … URL: https://onlinelibrary.wiley.com/journal/14390396