NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF UKRAINE

Department of Biochemistry named after Maksym Gulyi

APPROVED
Faculty of veterinary medicine
01.06. 2026

CURRICULUM OF ACADEMIC DISCIPLINE

Biochemistry of Animals with the Basics of Physical and Colloid Chemistry

Field of knowledge H Agriculture, forestry, fisheries and veterinary medicine
Specialty _H6 _ Veterinary Medicine _____
Academic programme ___ Veterinary Medicine _____
Faculty of Veterinary Medicine_____
Developed by: Liliia KALACHNIUK, Professor, Doctor of Biological Sciences, Professor

(position, academic degree, academic rank)

Kyiv – 2026

Description of the discipline Biochemistry of Animals with the Basics of Physical and Colloid Chemistry

(up to 1,000 printed characters)

«Biochemistry of Animals with the Basics of Physical and Colloid Chemistry» is a mandatory component of the educational program «Veterinary Medicine», which provides basic concepts about the chemical composition of animals, classification, functions of proteins, carbohydrates, lipids, minerals, enzymes, hormones and vitamins. The main ways of biochemical processes that provide homeostasis, energy balance, growth and development of animals are subject to study. Significant attention is paid to the study of the biochemical composition of biological fluids and tissues of animals and the processes that occur in them.

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Area of knowledge, specialty, academic programme, academic degree		
Academic degree	*«Master's»*	
Specialty	H6 «Veterinary Medicine»	
Academic programme	«Veterinary Medicine»	
Characteristics of the discipline		
Type	Compulsory	
Total number of hours	180	
Number of ECTS credits	6	
Number of modules	6	
Course project (work) (if any)	-	
Form of assessment	*exam / credit*	
Indicators of the discipline for full-time and part-time forms of university study		
	University study	
	Full-time	**Part-time**
Year of study	2	
Term	3, 4	
Lectures	*60 hours*	*hours*
Practical classes and seminars	*- hours*	*hours*
Laboratory classes	*90 hours*	*hours*
Self-study	*30 hours*	*hours*
Number of hours per week for full-time students	*5 hours*	

1. **Aim, competences and expected learning outcomes of the discipline**

Aim of the discipline "Biochemistry of Animals with the Basics of Physical and Colloid Chemistry" is to equip students by complete system of knowledge about the chemical composition of living organisms, physico-chemical and biological properties of natural compounds, the main pathways of metabolism, regulatory mechanisms and the relationship of metabolic processes that is to take on theoretical fundamentals of metabolic transformations and their regulation in animals and practical skills of their study

***List of academic disciplines that precede the study of* "Biochemistry of Animals with the Basics of Physical and Colloid Chemistry":** inorganic chemistry (1st year), biophysics (1st year), organic chemistry (1st year)

Competences acquired:

Integral competence (IC): the ability to solve complex tasks and problems in the field of veterinary medicine, which involves conducting research and/or implementing innovations and is characterized by the uncertainty of conditions and requirements

General competence (GC): GC 1) the ability to abstract thinking, analysis and synthesis; 2) the ability to apply knowledge in practical situations; GC 3) knowledge and understanding of the subject area and profession; GC 5) the ability to communicate in a foreign language; GC 11) ability to evaluate and ensure the quality of work performed ; GC 13) ability to make decisions and act in accordance with the principle of non-acceptance of corruption and any other manifestations of dishonesty.

Special (professional) competence (SC): SC 1) the ability to establish the features of the structure and functioning of cells, tissues, organs, their systems and apparatus of animals of different classes and species - mammals, birds, insects (bees), fish and other vertebrates; SC 2) the ability to use tools, special devices, instruments, laboratory equipment and other technical means to carry out the necessary manipulations during professional activities; SC 3) the ability to follow the rules of labor protection, asepsis and antiseptics during professional activities, the ability to use modern knowledge of the laws of biochemistry of different species of animals to effectively manage the treatment of animals and the use of medicines.

Expected learning outcomes (ELO): to determine the essence of physico-chemical and biological processes that occur in the body of animals in normal and pathological conditions.

2. Programme and structure of the discipline

Modules and topics	**Number of hours**												
	full-time							**full-time**					
	weeks	weeks	weeks					weeks	weeks				
			l	p	lab	ind.	s.st.		l	p	lab	ind.	s.st.
Module 1. Basics of Physical and Colloid Chemistry													
Topic 1. Biochemistry of Animals is the history of its development and its place among the natural sciences.	1-2	5	2		2		1						
Topic 2. Basics of Physical Chemistry	2-4	14	6		8								
Theme 3. Basics of Colloid Chemistry	5-6	12	4		6		1						
Total for module 1	***30***		***12***		***16***		*2*						
Module 2. Physico-chemical methods of research in biochemistry													
Topic 1. Physico-chemical methods of research in biochemistry	7-9	22	4		8		3						
Total for module 2	***15***		***4***		***8***		***3***						
Module 3. Biochemistry: Statics													
Topic 1. Cell and its organic compounds. Carbohydrates	10-11	12	4		8		4						
Topic 2. Lipids and biomembranes	12	8	2		4		2						
Topic 3. Amino acids, peptides, proteins,	13-14	10	6		4		2						
Topic 4. Nucleosides, nucleotides and nucleic acids	15	7	2		5		2						
Total for module 3	*45*		***14***		***21***		10						
Module **4**. Regulatory effects of inorganic and organic substances on the metabolism													
Topic 1. Biological membranes. Water and minerals in animals and plants, biochemistry of transmembrane transfers of minerals and organic	1	7	2		4	-	1						

substances.													
Topic 2. Vitamins. Coenzymes	2	7	2		4	-	1						
Topic 3. Enzymes and their kinetic properties	3	7	2		4	-	2						
Topic 4. Hormones and mechanisms of their influence on metabolic processes	4	7	2		4	-	2						
Total for content module 4	**30**		***8***		***16***	-	**6**						
Module **5**. Dynamic and Functional Biochemistry													
Topic 1. Biochemistry of digestion and features of digestive processes in different organisms	5	5	2		2		1						
Topic 2. Carbohydrate metabolism and its features in different species of animals	6-7	13	4		8		1						
Topic 3. Amphibolic transformation of organic substances (TCAC). Energy of biochemical processes	8	7	2		4								
Topic 4. Metabolism of lipids	9	5	4		2		1						
Topic 5. The metabolic processes of proteins and some amino acids	10-11	9	4		4								
Topic 6. Catabolism and anabolism of nucleotides and nucleic acids	12	7	2		4								
Total for module 5	***45***		***18***		***24***		***3***						
Module **6**. Metabolism and its reflection in the biochemical parameters													
Topic 1. Some biochemical parameters of biological fluids as a reflection of the state of metabolism in the organism	13-14	7	2		2		3						
Topic 2. Biochemistry of products of animal origin	14-15	7	2		3		3						
Total for module 6	***15***		***4***		***5***		***6***						
Total hours	**180**		**60**		**90**		**30**						

3. **Topics of lectures**

No.	Topic	Hours
Module 1. Basics of Physical and Colloid Chemistry		
1	Topic 1. Biochemistry of Animals is the history of its development and its place among the natural sciences.	2
2	Topic 2. Basics of Physical Chemistry	6
3	Theme 3. Basics of Colloid Chemistry	4
Module 2. Physico-chemical methods of research in biochemistry		

4	Topic 1. Physico-chemical methods of research in biochemistry	4
Module 3. Biochemistry: Statics		
5	Topic 1. Cell and its organic compounds. Carbohydrates	4
6	Topic 2. Lipids and biomembranes	2
7	Topic 3. Amino acids, peptides, proteins,	6
8	Topic 4. Nucleosides, nucleotides and nucleic acids	2
Module **4**. Regulatory effects of inorganic and organic substances on the metabolism		
9	Topic 1. Biological membranes. Water and minerals in animals and plants, biochemistry of transmembrane transfers of minerals and organic substances.	2
10	Topic 2. Vitamins. Coenzymes	2
11	Topic 3. Enzymes and their kinetic properties	2
12	Topic 4. Hormones and mechanisms of their influence on metabolic processes	2
Module **5**. Dynamic and Functional Biochemistry		
13	Topic 1. Biochemistry of digestion and features of digestive processes in different organisms	2
14	Topic 2. Carbohydrate metabolism and its features in different species of animals	4
15	Topic 3. Amphibolic transformation of organic substances (TCAC). Energy of biochemical processes	2
16	Topic 4. Metabolism of lipids	4
17	Topic 5. The metabolic processes of proteins and some amino acids	4
18	Topic 6. Catabolism and anabolism of nucleotides and nucleic acids	2
Module **6**. Metabolism and its reflection in the biochemical parameters		
19	Topic 1. Some biochemical parameters of biological fluids as a reflection of the state of metabolism in the organism	2
20	Topic 2. Biochemistry of products of animal origin	2
	Total	60

4. Topic of laboratory (practical, seminars) classes

No.	Topic (M1 – M3)	Hours
1-2	M-1. Rules of lab-work and safety in biochemical lab. Facilities, table wires, solutions and reagents of biochemical laboratory. Basics of Physical and Colloid Chemistry Solutions. pH. Methods of pH determination: indicator and ionometric. Determination of pH in the biological samples	4
	The buffered solution. Preparation of the acetate and phosphate buffers and calculation their pH. Determination of buffer capacity. Determination of influence of dilution on the buffered solution pH and capacity.	
3-4	Osmosis. Osmotic pressure in biological systems. The effect of solutions with different osmotic pressure on cells. Osmotic pressure in the erythrocytes. Fenomenon of the blood hemolysis caused by changes of osmotic pressure.	6
	Sorption and biological fenomena. Adsorbtional ability of such sorbents as electrolytes, dyes and sols. Adsorptional ability of coal. The processes of sorption and desorption. Fuxin adsorption on glass and its desorption.	
5-6	**Colloidal solutions.** The high molecular substances in biological fluids. Preparation of colloidal solutions using dispersion. Preparation of $Fe(OH)_3$ by method of hydrolysis. Preparation of sol of "Berlin blue". Preparation of sol of silver. Peculiarities of colloidal solutions. Determination of charge (+ or -) of particles. Coagulation of colloidal solutions. Study of colloidal protection. Irreversible coagulation of organic colloids	6

	Content Module 1. **Basics of Physical and Colloid Chemistry**	
7-8	M-2 Physico-chemical methods of research in biochemistry Spectophotometric and Colourmetric methods**.** Calibration graf building in the purpose of protein concentration determination with "biuret" reagent. Centrifugation. Preparation of glycogen from animal tissues by methods of Pfluger. Cell fractionation by centrifugation (model-experiment)	4
9-10	Fundamentals of electrophoretic separation of high molecular substances. Determination of protein fractions of blood serum by electrophoresis. Determination of protein fractions of blood serum by turbid-dimetric method. Methods of Chromatography. Calculation of R_f of lipid fractions in muscles for experimental results of some studies by thin layer chromatography. Separation of amino acids (or dyes) mixture by the method of paper chromatography. ContentModule 2. Physico-chemical methods of research in biochemistry	4
	M-3. Biochemistry: Statics **Carbohydrates**: colour tests on starch and glycogen. Colloidal peculiarities of starch. Acidic hydrolysis of starch. Cellulose dissolving in ammoniac solution of copper oxide (reagent of Shvaytzer). **Carbohydrates**: mono-, disaccharides. Identification of OH-groups in monosaccharaides. Reactions of oxidation of carbohydrates with aldehyde-group and reduction of metal ions in basic solution (Test of Trommer). Quantative determination of glucose in solution by Felling method. Selivanov test on ketohexose. Sucrose tests. Reduction of metal ions. Sucrose colour tests.	8
11-12	**Lipids and their components.** Fat identification. Acroleine test. Solubility of fats in different solvents. Formation of soap that is insoluble in water. Saponification of soap. In the fats, identification of unsaturated fatty acids (FA). Oxidation of unsaturated fats.	
	Amino acids. Example of demonstration of amino acids separation by chromatography. Qualitative tests on amino acids: xantoprotein reaction on amino acids; tryptophan test (reaction of Adamcevich); reaction on sulfur containing amino acids (reaction of Foley). Destruction of amino acids by nitrous acid.	4
13-14	**Amides of acids.** Urea and its peculiarities: preparation nitrate-acidic salt of urea; distruction of urea at heating; biurett reaction**.** **Proteins**. Biuret reaction. Reversible reaction of protein sedimentation by ammonium sulfate and by alcohol. Irreversible reaction of protein sedimentation by salts of heavy metals, by reagents to alkaloids (tannin, potassium hexocianoferrat and picric acid), by concentrate inorganic acids, by organic acids and by boiling. Physical and Chemical peculiarities of proteins: determination of isoelectric point (pI) of protein (gelatin).	4
15	Nucleic acids and their components. Isolation of deoxyribonucleoprotein. Hydrolysis of nucleoprotein. DNA identification in deoxyribonucleoprotein. Pentose identification. Purines identification. Phosphoric acid determination in hydrolysates.	5
	Content Module 3. Biochemistry: Statics	
	Total hours	45

No.	Topic (M4-M6)	Hours
1.	M-4. Regulatory effects of inorganic and organic substances on the metabolism Role of mineral substances in the metabolic processes. The role of macro- and microelements in metabolism. Determination of trace element (Fe) and macronutrients (Mg, Cl) and using different methods in biological samples.	4
2.	Some representatives of vitamins. Coenzymes. Fat-soluble vitamins, their detection and role. Qualitative reactions to vitamins A (samples with ferric chloride and sulfuric acid), E (sample with nitric acid). Water-soluble vitamins, their role as coenzymes. Qualitative reactions to vitamins: B_1, B_2, B_5, and C. Quantitative determination of vitamins C and riboflavin (vitamin B_2) in biological samples	4
3.	Enzymes. Kinetic aspects Effect of temperature and pH on the activity of amylase. Specificity of enzymes (amylase). Determination of amylase activity. Effect of activators and inhibitors on enzyme activity. Kinetic properties of amylase.	4
4.	The role of hormones in metabolic processes Qualitative reactions to hormones. Qualitative reactions to adrenaline: tests with iodine and iron (III) chloride. Qualitative reactions to insulin: biuret reaction to insulin; reactions to sulfur-containing amino acids. Quantitative determination of adrenaline by colorimetric method.	4
5	Content Module 4. Regulatory effects of inorganic and organic substances on the metabolism.	2
6.	M-5. Dynamic and functional biochemistry Carbohydrate metabolism, its intermediates Investigation of the properties of mono- and disaccharides. Quantitative determination of glucose in a biosample by the Fehling method. Reaction to disaccharides. Barfed's reaction. Investigation of the properties of polysaccharides. Detection of glycogen in the liver. Isolation of glycogen by the Pfluger method. Glycogen hydrolysis. Determination of glycogen content in tissues. *Control work*: glycolysis, glycogenolysis, fermentation, pentose phosphate cycle	8
7	Biological oxidation of substances and their energy metabolism Quantitative determination of lactic acid in the serum of animals by colorimetric method and its detection in muscles; determination of muscle adenosine triphosphatase activity. *Control work*: TCAC, biological oxidation	4
8	Lipid metabolism and its intermediates Detection of fats. Acrolein test. Determination of iodine and acid number of fat. Qualitative reaction to bile acids. *Control work*: β-oxidation of FA	2
9	Protein metabolism intermediates and their characteristics (I) Influence of temperature and reaction of the environment on the solubility of proteins. Physico-chemical properties of proteins. Determination of the isoelectric point of a protein (casein). Protein precipitation reactions (organic acids: trichloroacetic, picric; organic solvents: alcohol, acetone). Quantitative determination of protein by the Lowry method. *Control work*: transformation of amino acids	2
10	Protein metabolism intermediates and their characteristics (II)	

	Qualitative reactions to aromatic amino acids. Reaction to phenylalanine, tyrosine, and tryptophan. Reaction to tyrosine. Reaction to tryptophan. Reaction to thioamino acids. *Control work*: synthesis of urea	2
11	Nucleic acid metabolism intermediates. Isolation of nucleoproteins from the liver of animals and study of their chemical composition Detection of DNA in deoxyribonucleoprotein. Qualitative reaction to the presence of phosphoric acid *Control work*: synthesis of uric acid	2
12	Content Module 5. Dynamic and Functional Biochemistry	2
13	M-6. Metabolism and its reflection in biochemical parameters Biochemical parameters of biological fluids Determination of inorganic components of urine (determination of chlorides, sulfates, phosphates). Determination of pathological components of urine (samples for protein, sugar, pigments, acetone bodies).	2
14	Biochemistry of products of animal origin Obtaining whey of milk. Precipitation and isolation of casein. Determination of milk acidity.	1
15	Content Module 6. Metabolism and its reflection in biochemical parameters	2
	Total hours	45

5. Topics of self-study

No.	Topic	Hours
Module 1. Basics of Physical and Colloid Chemistry		
1	Topic 1. Biochemistry of Animals is the history of its development and its place among the natural sciences.	1
2	Topic 2. Basics of Physical Chemistry	
3	Topic 3. Basics of Colloid Chemistry	2
Module 2. Physico-chemical methods of research in biochemistry		
4	Topic 1. Physico-chemical methods of research in biochemistry	10
Module 3. Biochemistry: Statics		
5	Topic 1. Cell and its organic compounds. Carbohydrates	
6	Topic 2. Lipids and biomembranes	2
7	Topic 3. Amino acids, peptides, proteins,	
8	Topic 4. Nucleosides, nucleotides and nucleic acids	
Module **4**. Regulatory effects of inorganic and organic substances on the metabolism		
9	Topic 1. Biological membranes. Water and minerals in animals and plants, biochemistry of transmembrane transfers of minerals and organic substances.	1
10	Topic 2. Vitamins. Coenzymes	1
11	Topic Enzymes and their kinetic properties	1
12	Topic 4. Hormones and mechanisms of their influence on metabolic processes	1
Module **5**. Dynamic and Functional Biochemistry		
13	Topic 1. Biochemistry of digestion and features of digestive processes in different organisms	1
14	Topic 2. Carbohydrate metabolism and its features in different species of animals	1
15	Topic 3. Amphibolic transformation of organic substances (TCAC). Energy of biochemical processes	1
16	Topic 4. Metabolism of lipids	1
17	Topic 5. The metabolic processes of proteins and some amino acids	1

18	Topic 6. Catabolism and anabolism of nucleotides and nucleic acids	1
Module **6**. Metabolism and its reflection in the biochemical parameters		
19	Topic 1. Some biochemical parameters of biological fluids as a reflection of the state of metabolism in the organism	3
20	Topic 2. Biochemistry of products of animal origin	2
	Total	***30***

6. Methods of assessing expected learning outcomes:

– oral or written survey;
– interview;
– test;
– defending laboratory/practical, works, projects;
– peer-to-peer assessment, self-assessment.

7. Teaching methods*:*

– problem-based method;
– practice oriented studying method;
– case method;
– project education method;
– research based method;
– learning discussions and debates method;
– team work, brainstorm method.

8. Results assessment.

The student's knowledge is assessed by means of a 100-point scale converted into the national grades according to the "Exam and Credit Regulations at NULES of Ukraine" in force

8.1. Distribution of points by types of educational activities

Educational activity	Results	Assessment
Module 1. **Basics of Physical and Colloid Chemistry**		
Lectures 1-3	Theoretical basics of physical and colloidal chemistry	-
Lab class 1.	Mastering methods for determining pH:	**5**
Lab class 2.	Mastering work with buffer solutions	**5**
Lab class 3.	Mastering methodological approaches to studying osmosis, osmotic pressure in biological systems	**5**
Lab class 4.	Mastering methodological approaches to studying sorption and biological phenomena	**5**
Lab class 5.	Colloidal solutions. High-molecular compounds of biological fluids	**5**
Self-study 1.	Based on literary analysis, present your own vision of biochemistry and its place among the natural sciences and take a test	**10**
Self-study 2.	Based on literary analysis, take a test on the importance of colloidal protection for biology and medicine	**35**
Module control work 1.		**30**
Total for module 1		**100**
Module 2. **Physico-chemical methods of research in biochemistry**		
Lectures 1-2	Theoretical basics: Physicochemical research methods in biochemistry	-

Lab class 6.	Mastering spectrophotometric and photoelectrocolorimetric methods	**5**
Lab class 7.	Mastering centrifugation methods	**5**
Lab class 8-9.	Mastering the basics of electrophoretic and chromatographic separation of high-molecular compounds	**10**
Self-study 3.	Take the test after previously conducting a literature analysis on the topic: Physicochemical methods in biochemical research	**50**
Module control work 2.		**30**
Total for module 2		**100**
Module 3. **Biochemistry: Statics**		
Lectures 1- 4	Theoretical basics of static biochemistry	**-**
Lab class 10.	Study of carbohydrates: monosaccharides, disaccharides, polysaccharides, using methodological approaches	**10**
Lab class 11.	Study of lipids and their components using methodological approaches	**5**
Lab class 12.	Study of amino acids using methodological approaches	**5**
Lab class 13.	Study of acid amides using methodological approaches	**5**
Lab class 14.	Study of proteins using methodological approaches	**5**
Lab class 15.	Study of nucleic acids and their components using methodological approaches	**5**
Self-study 4.	Based on theoretical knowledge and analysis of scientific literature, pass a test on physicochemical methods in biochemical studies of carbohydrates, lipids, proteins, nucleic acids and their components	**35**
Module control work 3.		**30**
Total for module 3		**100**
Class work		**(M1 + M2+M3)/3*0,7 ≤ 70**
Credit		**30**
Total for year		**(Class work + credit) ≤ 100**
		100

Educational activity	**Results**	**Assessment**
Module 4. **Regulatory effects of inorganic and organic substances on the metabolism**		
Lectures 1-4	Theoretical material and some new scientific reports on the study of "Regulatory influence of inorganic and organic substances on metabolism"	**-**
Lab class 1.	Study of the regulatory influence of inorganic and organic substances on metabolism using methodological approaches	**5**
Lab class 2.	Study of individual representatives of vitamins using physico-chemical methodological approaches	**5**
Lab class 3.	Study of kinetic aspects of the interaction of enzymes with substrates using physico-chemical methodological approaches	**5**
Lab class 4.	Study of the characteristics and role of hormones in metabolic processes using physico-chemical	**5**

	methodological approaches	
Самостійна робота 1.	Based on the studied material provided from "Biological membranes. Water and minerals in the body of animals and plants, biochemistry of transmembrane transport of mineral and organic substances" to pass tests	**15**
Самостійна робота 2.	Based on the studied material provided from "Vitamins. Coenzymes" take tests	**15**
Self-study 3.	Based on the studied material provided from "Enzymes and their kinetic properties" take tests	**10**
Self-study 4.	Based on the studied material provided from "Hormones and their role in metabolic processes Mechanisms of regulatory influence on metabolism" take tests	**10**
Module control work 4.		**30**
Total for module 4		**100**
Module 5. **Dynamic and Functional Biochemistry**		
Lectures 1-6	Theoretical material and some new scientific reports on the study of "Dynamic and functional biochemistry"	**-**
Lab class 5.	Mastering methodological approaches to the study of "Carbohydrate metabolism, its intermediates: research of the properties of mono- and disaccharides and polysaccharides"	**10**
Lab class 6.	Mastering methodological approaches to the study of "Biological oxidation of substances and their energy metabolism"	**5**
Lab class 7.	Mastering methodological approaches to the study of "Lipid metabolism and its intermediates"	**5**
Lab class 8.	Mastering methodological approaches to the study of "Intermediates of protein metabolism and their characteristics"	**5**
Lab class 9.	Mastering methodological approaches to the study of "Intermediates of nucleic acid metabolism"	**5**
Self-study 5.	Based on the studied material provided on "Biochemistry of digestion and features of digestive processes in different organisms" to take tests	**10**
Self-study 6.	Based on the studied material provided on "Carbohydrate metabolism and its features in different animal species" to take tests	**10**
Self-study 7.	Based on the studied material provided on "Amphibolic transformations of organic compounds (CTC). Energetics of biochemical processes" take tests	**5**
Self-study 8.	Based on the studied material provided from "Lipid metabolism" take tests	**5**
Self-study 9.	Based on the studied material provided from "Metabolic processes of proteins and individual amino acids" take tests	**5**
Self-study 10.	Based on the studied material provided from "Catabolism and anabolism of nucleotides and nucleic acids" take tests	**5**
Module control work 5.		**30**
Total for module 5		**100**
Module 6. **Metabolism and its reflection in the biochemical parameters**		

Lectures 1-2	Theoretical material and separate new scientific reports on the study of "Metabolism and its reflection in biochemical indicators"	**-**
Lab class 10.	Demonstrate mastery of methods for determining "Biochemical indicators of urine"	**5**
Lab class 11.	Demonstrate mastery of methods for determining "Biochemical indicators of milk"	**5**
Self-study 11.	Based on the studied provided material from "Certain biochemical indicators of biological fluids as a reflection of the state of metabolism in the body. Biochemical indicators of urine" take tests	**30**
Self-study 12.	Based on the studied provided material from "Biochemical indicators of milk. The influence of exogenous factors on animal productivity" take tests	**30**
Module control work 6.		**30**
Total for module 6		**100**
Class work		**(M4 + M5+ M6)/3*0,7 ≤ 70**
Exam/credit		**30**
Total for year		**(Class work + Exam) ≤ 100**

Educational activity	**Results**	**Assessment**
Module 1. **Title**		
Lecture 1 (*if assessed*)		**-**
Laboratory/practical work 1.		**10**
Self-study *(if any)* 1.		**5**
Lecture 2 (*if assessed*)		**-**
Laboratory/practical work 2.		**15**
Self-study *(if any)* 2.		**10**
…		**…**
Module control work 1.		**30**
Total for module 1		**100**
Module 2. **Title**		
…		
Module control work 2.		
Total for module 2		**100**
Class work		**(M1 + M2)/2*0,7 ≤ 70**
Exam/credit		**30**
Total for year		**(Class work + exam) ≤ 100**
Course project/work (*if any*)		**100**

8.2. Scale for assessing student's knowledge

Student's rating, points	National grading (exam/credits)
90-100	excellent

74-89	good
60-73	satisfactory
0-59	unsatisfactory

8.3. Assessment policy

Deadlines and exam retaking rules	*EXAMPLE:* works that are submitted late without valid reasons will be assessed with a lower grade. Module tests may be retaken with the permission of the lecturer if there are valid reasons (e.g. a sick leave).
Academic integrity rules	*EXAMPLE:* cheating during tests and exams is prohibited (including using mobile devices). Term papers and essays must have correct references to the literature used
Attendance rules	*EXAMPLE:* Attendance is compulsory. For good reasons (e.g. illness, international internship), training can take place individually (online by the faculty dean's consent)

9. Teaching and learning aids:

- e-learning course of the discipline (*https://elearn.nubip.edu.ua) MANDATORY*;
- references to digital educational resources;
- textbooks, manuals, tutorials;
- guidelines for studying a discipline by full-time and part-time students;
- internship programmes of the discipline (if included in the curriculum).

10. Recommended sources of information

1. Biochemistry of animals with the basics of physical and colloid chemistry. L. Kalachniuk, V. Tomchuk. [Manual] Kyiv – 2022. 240 p.
2. Koolman J., Röhm K-H. Color Atlas of Biochemistry. Thieme. 2013. 506 p.
3. Спеціальна біохімія : навчальний посібник для студентів вищих навчальнихзакладів[Заредакцією член-кореспондента НААУ С.Д. Мельничука.] Автори: С.Д. Мельничук, С.В.Хижняк, В.І. Цвіліховський, Грищенко, В.А. Томчук, Є.А. Деркач, Н.М. Мельникова,Л.Г. Калачнюк, Г.І. Калачнюк, О.М. Тупицька.– Київ, 2014. – 371с.
4. Біохімія. Підручник / Л..І. Остапченко, Т.Р. Андрійчук, Ю.Д. Бабенюк та ін. / Заред. Л.І.Остапченко / – К.: Видавничо-поліграфічний центр «Київський університет», 2012. –796с.
5. Губський Ю.І. Біологічна хімія. Київ – Вінниця: Нова книга, 2007. – 655 с.
6. Thomas D. Pollard, William C. Earnshaw, Ph. D. Cell biology. – Elseviar Sciense (USA), 2002.– 804 p.
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