

Ministry of Education and Science of Ukraine
Sumy National Agrarian University
Faculty of Veterinary Medicine
Department of Internal Medicine, Pharmacy and Biochemistry

Work program (syllabus) of the educational component

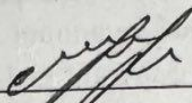
**Veterinary clinical biochemistry of animals with the basics of physical and
colloidal chemistry**
(mandatory)

Specialty	211 Veterinary medicine
Educational program	Veterinary medicine
Level of higher education	Second Master's level of higher education

Розробники: _____

(підпис)

(прізвище, ініціали) (вчений ступінь та звання, посада)


(підпис)

Морозов Б.С., к.вет.н, старший викладач

(прізвище, ініціали) (вчений ступінь та звання, посада)

Розглянуто, схвалено
та затверджено на
засіданні кафедри
внутрішніх хвороб,
фармації та біохімії

протокол від 09.06.2025 р. № 17

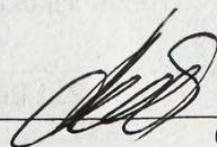
Завідувач
кафедри


(підпис)

Нечипоренко О.Л.
(прізвище, ініціали)

Погоджено:

Гарант освітньої програми _____


(підпис)

Олександр Чекан
(ПІБ)

Декан факультету, де реалізується освітня програма _____

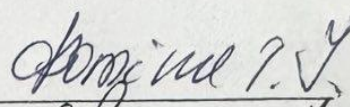
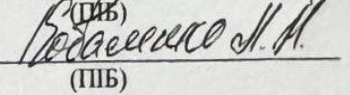
(підпис)

Людмила Нагорна
(ПІБ)

Рецензія на робочу програму надана: _____

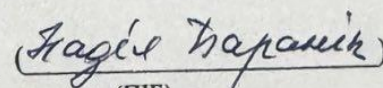

(підпис)

(підпис)


(ПІБ)

(ПІБ)

Методист відділу якості освіти,
ліцензування та акредитації _____

(підпис)


(ПІБ)

Зареєстровано в електронній базі: дата: 02.07 2025 р.

Developers: _____

(signature)

(last name, initials)

(academic degree and title, position)

_____ **Morozov B.S., Doctor of Philosophy**

(signature)

(last name, initials)

(academic degree and title, position)

Reviewed, approved and ratified at a meeting of the Department of Internal Medicine, Pharmacy and Biochemistry	protocol dated 09.06.2025. No. 17
	Manager departments _____ (signature) Nechiporenko O.L. (last name, initials)

Agreed:

Guarantor of the educational program _____ Halyna **RIABENKO**
(signature) (Full name)

Dean of the faculty where the educational program is implemented _____ Liudmyla **NAHORNA**
(signature) (Full name)

Review of the work program provided by:

(signature) (Full name)

(signature) (Full name)

Methodologist of the Department of Educational Quality,
licensing and accreditation _____ (
(signature) (Full name)

Registered in the electronic database: date: _____ 2025.

Information on reviewing the work program (syllabus):

Academic year in which changes are made	Number of the appendix to the work program with a description of the changes	Changes reviewed and approved		
		Date and number of the minutes of the department meeting	Head of the Department	Educational program guarantor

1. GENERAL INFORMATION ABOUT THE EDUCATIONAL COMPONENT

1.	Name OK	OK 34. Veterinary clinical biochemistry of animals with the basics of physical and colloidal chemistry		
2.	Faculty/department	Veterinary Medicine/Internal Medicine, Pharmacy and Biochemistry		
3.	Status OK	Mandatory		
4.	Program/Specialty(s) that include OK for	Specialties 211 "Veterinary Medicine"		
5.	OK can be offered for	-		
6.	Semester and duration of study	6th year, 1st semester (weeks 1-15)		
7.	Number of ECTS credits	4		
8.	Total hours and their distribution 120	Contact work (classes)		Independent work
		Lectures	Practical/seminar	Laboratory
		14		30
				76
9.	Language of instruction	English		
10.	Teacher/Educational Component Coordinator	Teacher: PhD, Senior Lecturer Morozov Bogdan Stanislavovich		
11.1	Contact information	Workplace: room 25, veterinary medicine building E-mail: MorozovBS@meta.ua Tel. (066) 3130411 Consultation hours: every Monday from 12:00 to 13:00		
11.	General description of the educational component	The educational component includes sections on clinical biochemistry with the basics of physical and colloidal chemistry, which are necessary for a deep understanding of the essence of biochemical processes that occur in the animal body normally and during pathology of the organism. The subject of this course is chemical laws and reactions that underlie the physiological and biochemical functions of a living organism. The study of the discipline involves students' practical mastery of laboratory methods of research of samples of biological material of animals, the ability to interpret their results and substantiate the established diagnosis.		

12.	Purpose of the educational component	The goal of the introductory course is to master the theoretical and practical foundations of organic chemistry and clinical biochemistry, which will allow the student to form a complex of chemical knowledge and skills aimed at the active formation of professional skills necessary for understanding the peculiarities of the functioning of the animal body.
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13.	Prerequisites for studying OK, connection with other educational components of OP	1. The educational component is based on knowledge of chemistry (terminology, basic laws and concepts, atomic structure, types of chemical bonds), physics (understanding the basic laws of chemical reactions), and experimental techniques (knowledge of chemical glassware, concentrations). 2. The educational component is the basis for the OK "Veterinary pharmacology of medicinal and poisonous plants", "Veterinary toxicology", "Clinical and laboratory diagnostics of animal diseases", "System of analysis of hazardous factors and control at critical points"
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14.	Academic Integrity Policy	Compliance with academic integrity for higher education applicants involves: independent completion of educational tasks, tasks of current and final control of learning outcomes; references to sources of information when using ideas, statements, and information; compliance with copyright legislation; provision of reliable information about the results of one's own educational or scientific activities. Violations of academic integrity when studying the OC "Organic Chemistry with Clinical Biochemistry" are considered: academic plagiarism, academic fraud (copying, cheating, passing off someone else's work as your own), use of electronic devices during the final knowledge control For violation of academic integrity, students may be held accountable for the following academic responsibilities: Academic plagiarism– score 0, re-execution of the task. Academic fraud– cancellation of points received; re-taking the assessment; re-performing work not completed independently; Use of electronic devices during the final knowledge test– suspension from work, score 0, re-passing the final control
15.	Keywords	https://cdn.snau.edu.ua/moodle/course/view.php?id=3435 acid-base balance, buffer systems of biological fluids, electrolyte dissociation, osmotic pressure, osmosis, dialysis, solutions, solubility, dissociation constant, thermodynamics of biochemical processes, colloidal systems (sols, gels, emulsions), colloid stability, coagulation, peptization, electrokinetic potential, protective effect of colloids, proteins as colloidal particles, metabolism of proteins, lipids, carbohydrates, enzyme activity (ALT, AST, LF, GGT), dysproteinemia, azotemia (prerenal, renal, postrenal), hypoproteinemia / hyperproteinemia, hypoglycemia / hyperglycemia.

2. LEARNING OUTCOMES BY EDUCATIONAL COMPONENT AND THEIR RELATIONSHIP WITH PROGRAM LEARNING OUTCOMES

Learning outcomes for OK: After studying the educational component, the student is expected to be able to...	Program learning outcomes that the OC aims to achieve (indicate the number according to the numbering given in the OP) ¹				How is the DRN assessed?
	PRN01	PRN02	PRN07	PRN15	
DRN 1. Understand the chemical nature of physiological processes in the animal body involving organic substances, which determines their subordination to basic chemical laws	x				Interactive testing to check the assimilation of theoretical material, exam
DRN 2. Establish the relationships between the chemical and biological processes that occur in the animal body normally and pathologically.		x			Taking a comprehensive written test, exam
DRN 3. Be able to use laboratory				x	Protection of

¹Must comply with the Matrix of ensuring program learning outcomes by the relevant components of the educational program, indicated for mandatory educational components of OP I and II levels, for all (mandatory and selective OK) OP III

Topic 2. The second law of thermodynamics.Analytical expression of the second law of thermodynamics for reversible and irreversible thermodynamic processes. Statistical nature of entropy. Entropy as a measure of probability. Entropy as a criterion of the direction of processes in isolated systems. Thermodynamic potentials and characteristic functions. Helmholtz-Gibbs equation. Chemical potential. Third law of thermodynamics. Topic 3.Phase equilibrium.Chemical equilibrium constant. One-component systems. Gibbs phase rule, its application. Water phase diagram. Two-component systems. Topic 4.Colligative properties of solutions. General characteristics of solutions. Ideal solutions. Vapor pressure above the solution. Raoult's laws. Ebullioscopy and cryoscopy. Gas solutions in liquids. Henry's law. Properties of nonelectrolyte solutions. Osmosis, osmotic phenomena, Van't Hoff's law. Determination of the freezing point of nonelectrolyte solutions, molecular weight of the solute and osmotic pressure of the solution. Real solutions. Positive and negative deviations from Raoult's law. Konovalov's laws. Distillation, rectification. Topic 5.Electrolyte solutions.Specific and equivalent electrical conductivity of a solution. Conductometry. Application of conductometric measurements to determine the concentration of system components in various branches of the food industry. Ion mobility, Kohlrausch's law of independence of ion motion. Fundamentals of the theory of strong electrolytes. Electrolyte activity, ionic strength of solutions. Topic 6. Electrode processes and electromotive forces.Electrode potential, physicochemical aspects of the structure of the electric double layer (EDL). Nernst equation. Electromotive forces (EMF).	2		2	2	2,3,4,7,11
			2	2	2,3,4,7,10
			2	4	2,3,4,7,10
			2		5.11
			2	4	
Topic 7. Chemical kinetics. Chemical reaction rate, rate	2		2		2,3,4,7

constant. Order and molecularity of a chemical reaction. Methods for determining the order of a reaction. Complex reactions: chain, sequential, parallel, conjugate. Limiting stage of a complex reaction.					
Topic 8. Catalysis.Catalysis. General properties of catalysts. Heterogeneous catalysis.			2	2	5.10
Topic 9. Methods for obtaining dispersed systems.Definition of colloidal chemistry as a modern science of surface phenomena and physicochemical properties of dispersed systems. The concept of colloidal systems. Signs of the colloidal state. The main features of the colloidal state: heterogeneity, high dispersion, large specific surface area. Colloidal systems as heterogeneous thermodynamic non-equilibrium systems. Molecular and ionic stabilizers, their role in providing temporary stability to a colloidal system. Classification of dispersed systems: by particle size of the dispersed phase, the aggregate state of the dispersed phase and the dispersion medium, the nature of the interaction between the dispersed phase and the medium, and mechanical properties. Obtaining dispersed systems by physical and chemical condensation methods.			2	4	2,3,4,6,7
			2	4	5.10
			2		2,3,4,6,6,7,11
				4	5.10
Topic 10. Surface phenomena.Surface tension as a measure of surface energy. Wetting phenomenon. Contact angle. Hydrophobicity and hydrophilicity of surfaces. Flotation. Adhesion, work of adhesion. Cohesion. Work of cohesion. Methods for determining surface tension. Determination of surface tension, free energy of a system, dispersion of a system, and surface area.			2		2,3,4,6,7,11
Topic 11. Adsorption.Adsorption and its types. Adsorption isotherm and empirical equation of Freundlich isotherm. Analysis and solution of this equation. Adsorption at the solid-gas			2		5.10

interface. Study of adsorption from solutions on a solid adsorbent. Adsorption at the solution-gas interface. Adsorbents and their characteristics. Methods for determining the specific surface area of adsorbents used in the food industry. Ion-exchange adsorption of strong electrolytes, its practical application: water purification, clarification of sugar syrups, wines, juices, etc. Nikolsky's equation.					
Topic 12. Molecular and optical properties of colloidal systems. Brownian motion. Diffusion. Features of osmotic pressure of colloidal systems. Optical properties of colloidal systems. Ultramicroscopy and electron microscopy. Nephelometry. Fluorescence. Determination of the size and shape of colloidal particles by optical methods. Topic 13. Electrokinetic properties of colloidal systems. The structure of micelles and colloidal particles. Theories of the formation of an electric double layer (EDL). Thermodynamic potential. Electrokinetic potential. Dependence of electrokinetic potential on the concentration of electrolytes, the valence of the coagulant ion. Electrokinetic phenomena: electrophoresis, electroosmosis. Determination of electrokinetic potential by electroosmosis and electrophoresis methods	2		2	2	2,3,4,6,7,8,11
			2	4	5.10
			2	4	5.10
Total	14		30	76	

4. TEACHING AND LEARNING METHODS

DRN	Teaching methods(work that will be carried out by the teacher during classroom lessons, consultations)	Number of hours	Teaching methods(what types of learning activities should the student perform independently)	Number of hours
DRN 1. Understand the chemical nature of physiological processes in the animal body involving organic substances, which	<i>Explanatory and reproductive</i> methods: lecture, story-explanation, conversation, aimed at identifying the value-oriented content of the educational material (in the context of professional tasks)	20	working with textbooks, manuals, Internet materials; illustration, demonstration, performing experiments, exercises, didactic tasks, independent work, etc.	20

determines their subordination to basic chemical laws	Using the platform MOODLE, PADLET, ZOOM during blended learning.			
DRN 2. Establish the relationships between the chemical and biological processes that occur in the animal body normally and pathologically.	<i>Partial search methods:</i> problem-dialogical, modeling, case method, etc. <i>Inductive methods</i> —related to predicting observations and experiments based on experience data Using the platform MOODLE, Google Meet, ZOOM during blended learning.	20	independent search for educational information, performance of laboratory work of partial search content, complex didactic tasks and tasks.	20
DRN 3. Be able to use laboratory equipment and chemical reagents in compliance with the rules for their safe storage and use when conducting specialized research	<i>Visual methods</i> —demonstration of experiments <i>Practical methods</i> —work with reagents, laboratory glassware and instruments in compliance with safety regulations.	18	Preparation for laboratory work, execution and preparation of a report on the results of laboratory work	18
DRN 4. Formulate conclusions, recommendations, advice on the maintenance, feeding and treatment of animals or establish a diagnosis based on the results of laboratory tests	<i>Deductive methods</i> – related to the formulation of general provisions, formulas, laws and their application to specific tasks. <i>Inductive methods</i> —related to predicting observations and experiments based on experience data	18	Reading literature on the topic, preparing for a laboratory session, performing and writing a report on the results of laboratory work	16

5. EVALUATION BY EDUCATIONAL COMPONENT

5.1. Diagnostic assessment (indicated as needed)

5.2. Summative assessment

5.2.1. To assess the expected learning outcomes, there are

No.	Summative assessment methods	Points / Weight in the overall score	Date of compilation
1.	Preparation of a comprehensive written control	(3x15) points / 45%	7, 10, 14 weeks
2.	Laboratory work report	25 points / 25%	until 14-15 weeks
3.	Final control: exam	30 points / 30%	Exam week

5.2.2. Evaluation criteria

Component²	Unsatisfactorily	Satisfactorily	Good	Perfectly³
Preparation of a comprehensive written thematic control (3 papers)	<5 <i>points</i>	5-8 <i>points</i>	9-12 <i>points</i>	13-15 <i>points</i>
	A shortened condition of the problem has been drawn up, reaction equations and formulas are missing	A shortened problem statement was drawn up, calculations were performed only using the ready-made formula	The necessary formulas of substances and reaction equations are given, the solutions to the problems contain errors.	The tasks are completed in full, the presentation is logical and rational, the conclusions and generalizations are well-reasoned.
Laboratory work report	<5 <i>points</i>	6-15 <i>points</i>	16-22 <i>points</i>	23-25 <i>points</i>
	the main content of the material is not presented, conclusions and generalizations are lacking	There are gaps in the presentation of the material, the presentation is not systematized, the conclusions and generalizations are poorly argued, and there are errors in them.	There are minor shortcomings in the presentation of the material, the presentation is not sufficiently systematized, and there are some inaccuracies in the conclusions and generalizations.	the material is presented in full, the presentation is logical, the conclusions and generalizations are well-reasoned
Final control: exam	<14 points	15-20	21-26	27-30
	Ticket issues not resolved	No more than two tasks are revealed	No more than three tasks revealed	Three tasks are revealed and a practical solution is proposed.

5.3. Formative assessment:

To assess current progress in learning and understand areas for further improvement,

No.	Elements of formative assessment	Date
1	Interactive testing to check the mastery of lecture material	10 minutes at the beginning of the lab session
2	Checking individual homework, discussion with the teacher and self-correction of the work done by students	Within a week after execution
3	Survey and oral comments from the teacher on its results	weekly
4	Verification of the results of experiments for laboratory work with feedback	Within a week after execution

²Specify the summative assessment component

³Indicate the distribution of points and the criteria that determine the level of assessment

6. LEARNING RESOURCES (LITERATURE)

6.1 Main sources

5.3.1. Textbooks and manuals

1. Veterinary clinical biochemistry: textbook / V.I. Levchenko et al. ed. V.I. Levchenko and V.V. Vlizla. 2nd ed., revised and supplemented. Bila Tserkva, 2019. 416
2. Organic Chemistry / Snitynskyi V.V., Fedevich E.V., Solovodzinska I.E., Shkumbatyuk R.S., Vishchur O.I. — Lviv: SPOLOM, 2016. — 300 p.
3. Organic chemistry. Practical course: a teaching aid for agricultural students of III-IV levels of accreditation in the specialties "Veterinary medicine", "Zooengineering", "Agronomy" / O. I. Kononsky. - K.: Higher school, 2002. - 248 p.
4. Biochemistry. Workshop/ L.I. Ostapchenko, I.V. Kompanets, O.V. Skopenko and others. – Kyiv: Publishing and Printing Center *Kyiv University*, 2018.- p.296
5. Biochemistry short course. Part 1. / Z.M. Skorobagatova, M.A. Stashkevych, A.G. Matvienko. – Biokompozit, 2021. – 148 p.
6. **Analytical Chemistry: A Toolkit for Scientists and Laboratory Technicians**, 2nd Edition (2024) Authors: Bryan M. Ham, Aihui MaHam, Wiley Focus: a comprehensive guide for laboratories - methods, techniques, safety, instrumental approaches.
7. **Basics of Analytical Chemistry and Chemical Equilibria: A Quantitative Approach**, 2nd Edition (2023) Author: Brian M. Tissue, Wiley Focus: fundamental principles, calculations, chemical equilibrium for analysts.
8. **Bioinorganic Chemistry: A Short Course, 3rd Edition** Author: Rosette M. Roat-Malone, Wiley Publishing, January 2020 Description: A compact, modern introduction to bioinorganic chemistry - metal-ligand interactions in biology, enzymatic mechanisms, physicochemical approach

5.3.2. Methodological support

9. **Morozov B.S.** Bioinorganic and analytical chemistry. Methodological guidelines for conducting laboratory and practical classes. Methodological guidelines for students of the Faculty of Veterinary Medicine of the full-time form of Sumy. 2023. – 33 p.
10. **Morozov B.S.** Bioinorganic and analytical chemistry "Methodological instructions for conducting laboratory work". Methodological instructions for students of the Faculty of Veterinary Medicine of the full-time form of Sumy. 2023. – 25 p.
11. **Morozov B.S.** Biological Chemistry. Part 1. Methodological guidelines for conducting practical classes for students of the Faculty of Veterinary Medicine of full-time study for the educational degree 'Master' of Sumy. 2024. 39 p.
12. **Morozov B.S.** Biological Chemistry. Part 2. Methodological guidelines for conducting practical classes for students of the Faculty of Veterinary Medicine of full-time study for the educational degree 'Master' of Sumy. 2024. 35 p.
13. **Morozov B.S.** Biological Chemistry. Part 3. Methodological guidelines for conducting practical classes for students of the Faculty of Veterinary Medicine of full-time study for the educational degree 'Master' of Sumy. 2025. 36 p.
14. **Morozov B.S.** Biological Chemistry. Part 4. Methodological guidelines for conducting practical classes for students of the Faculty of Veterinary Medicine of full-time study for the educational degree 'Master' of Sumy. 2025. 40 with.

5.4. Additional sources

15. Kravchenko M.Y., Ivchenko V.D. Organic chemistry: methodological instructions for performing laboratory work for 1st year students of specialties 211 “Veterinary medicine”, 212 “Veterinary hygiene, sanitation and expertise” of the educational degree “master”. – Sumy, 2021. – 36 p.
16. Kravchenko M.Y., Ivchenko V.D. Organic Chemistry. Methodological instructions for independent study of the module "Theoretical foundations of organic chemistry" by 1st year students of specialties 211 "Veterinary medicine" and 212 "Veterinary hygiene, sanitation and expertise" of the educational degree "master" - Sumy: SNAU, 2021. - 37 p.
17. Kravchenko M.Y., Ivchenko V.D. Organic chemistry. Part 1. Hydrocarbons: lecture notes for 1st year students of specialties 211 “Veterinary medicine”, 212 “Veterinary hygiene, sanitation and expertise” of the educational degree “master”. – Sumy, 2021. – 51 p.

6.2. Software

Software(to support distance learning (Moodle), Zoom, Google Meet, etc.)