MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
SUMY NATIONAL AGRARIAN UNIVERSITY
Faculty of Veterinary Medicine
Department of therapy, pharmacology, clinical diagnostics and biochemistry

MODULE SYLLABUS

Bioinorganic and analytical chemistry

_ required __

Implemented in the "Veterinary Medicine" Academic Program

Area of specialization 211 " Veterinary Medicine"

at the second (master 's) level of higher education

Sumy – 2024

Author: _____ Morozov B.S. **doctor of philosophy**

Considered, approved and approved at the meeting of the department therapy, pharmacology, clinical diagnostics and biochemistry _____	protocol from 05.06.2024 № 15
	The head departments _____

Approved by:

Guarantor of the Academic program _____

Dean of the Faculty _____ (O. Nechyporenko)

Work program review (attached) provided: _____

Methodist of the Department of Education Quality, licensing and accreditation _____ (signature) (Full name)

Registered in the electronic database: date: 21.06. 2024

Author: _____ Morozov B.S. **doctor of philosophy**

Considered, approved and approved at the meeting of the department therapy, pharmacology, clinical diagnostics and biochemistry _____	protocol from 05.06.2024 № 15
	The head departments _____ _____

Approved by:

Guarantor of the Academic program _____

Dean of the Faculty _____(O. Nechyporenko)

Work program review (attached) provided: _____

_____

Methodist of the Department of Education Quality,
licensing and accreditation _____ (_____)
(signature) (Full name)

Registered in the electronic database: date: _____2024

Syllabus review data:

Academic year in which changes are made	The number of the application to the work program with a description of the changes	The changes have been reviewed and approved		
		Date and number of the minutes of the meeting of the department	Head of Department	Guarantor of the educational program

1. GENERAL INFORMATION ABOUT THE EDUCATIONAL COMPONENT

<table>
<tr><td>1.</td><td>The name is OK</td><td colspan="4">Bioinorganic and analytical chemistry</td></tr>
<tr><td>2.</td><td>Faculty/department</td><td colspan="4">Veterinary medicine/therapeutics, pharmacology, clinical diagnostics and biochemistry</td></tr>
<tr><td>3.</td><td>The status is OK</td><td colspan="4">Obligatory</td></tr>
<tr><td>4.</td><td>Program/Specialty (programs), the component of which is OK for</td><td colspan="4">Specialties 211 "Veterinary Medicine"</td></tr>
<tr><td>5.</td><td>OK can be offered for</td><td colspan="4">-</td></tr>
<tr><td>6.</td><td>NRK level</td><td colspan="4">7th level</td></tr>
<tr><td>7.</td><td>Semester and duration of study</td><td colspan="4">1 course 1 semester (1-15 weeks)</td></tr>
<tr><td>8.</td><td>Number of ECTS credits</td><td colspan="4">5</td></tr>
<tr><td rowspan="3">9.</td><td rowspan="3">The total number of hours and their distribution

150</td><td colspan="3">Contact work (class)</td><td>Independent work</td></tr>
<tr><td>Lectures</td><td>Practical/seminar</td><td>Laboratory</td><td></td></tr>
<tr><td>2</td><td></td><td>6</td><td>142</td></tr>
<tr><td>10.</td><td>Language of education</td><td colspan="4">Ukrainian</td></tr>
<tr><td>11.</td><td>Teacher/Coordinator of the educational component</td><td colspan="4">Bogdan Stanislavovych Morozov</td></tr>
<tr><td>11.1</td><td>Contact Information</td><td colspan="4">PIP: Bogdan Stanislavovych Morozov
Position: Doctor of Philosophy of the Department of Therapy, Pharmacology, Clinical Diagnostics and Biochemistry
Workplace: office. 25 building of veterinary medicine
E-mail: MorozovBS@meta.ua
Tel. (066) 3130411
Consultation hours: every Monday from 13:00 to 14:00</td></tr>
<tr><td>12.</td><td>General description of the educational component</td><td colspan="4">The educational component includes sections of organic chemistry and clinical biochemistry, which are necessary for a deep understanding of the essence of biochemical processes that occur in the body of animals in normal and pathological conditions.
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 the methods of laboratory research of samples of biological material of animals, the ability to interpret their results and substantiate the established diagnosis</td></tr>
</table>

13.	The purpose of educational component	Formation of students' scientific outlook on issues of unity and relationship of living and inorganic matter, distribution and role chemical elements, processes in nature and living organisms; and formation of students' experimental skills of chemical analysis substances
14.	Study prerequisites OK, communication with other educational components of OP	1. Educational component is based on knowledge of chemistry (terminology, basic laws and concepts, properties of ions depending on them being in the periodic table of D.I. Mendeleev), physics (understanding the main patterns of chemical flow reactions), basics of higher mathematics (calculations), experimental techniques (knowledge of chemical utensils, concentrations). 2. Educational component is the basis for study components: "Organic chemistry with clinical biochemistry", "Vetfarm medicinal and poisonous plants", "Veterinary toxicology", "Clinical and laboratory diagnosis of animal diseases", "System of analysis of dangerous factors and control at critical points"
15.	Academic policy integrity	Observance of academic integrity for students of higher education involves: independent performance of educational tasks, tasks current and final control of training results; link to sources of information in the case of using ideas, statements, information; compliance with copyright legislation; granting reliable information about one's own educational or scientific results activity Violation academic integrity at studies OK "Bioinorganic and analytical chemistry" are considered: academic plagiarism, academic fraud (writing off, deception, falsification of completed work for one's own), use of electronic devices during final control of knowledge.By violation students of academic integrity can be involved in the following academic responsibility: **Academic plagiarism**- score 0, repeat the task. **Academic fraud**– cancellation of received points; repeated Passing the assessment, re-implementation of a non-independently performed one works; **Use of electronic devices during the final exam** **knowledge control**– suspension from work, grade 0, re-passing the final control

2. LEARNING RESULTS UNDER THE EDUCATIONAL COMPONENT AND THEIR RELATIONSHIP WITH PROGRAM RESULTS OF LEARNING

Study results for OK: After study educational component the student is expected to be able to…"	Program results studies, to achieve which directed OK (note number according to numbering, given in OP)1				How RND is estimated
	PRN 1	PRN 3	PRN 7	PRN 15	
DRN 1. To understand the chemical nature of the processes in the animal's body, which determines their subordination to the basic chemical laws	+	+		+	Multiple choice tests and for compliance; solution situational tasks; exam
DRN 2. Establish relationships passage of chemical and biological processes that occur in the body of animals in normal and pathological conditions	+	+		+	Multiple choice tests and compliance; solving situational problems tasks; exam
DRN 3. Analyze performance processes, right using devices, laboratory utensils, reagents, materials, observing the safety rules	+	+			Multiple choice tests and for compliance; protocols laboratory work; exam
DRN 4. Apply optimal ones methods and tools for research, collection and data processing	+	+		+	Presentation with report; exam
DRN 5. Know the measures aimed at To protect the environment when using chemicals and their waste	+		+		Oral survey; exam; solving situational problems tasks

3. CONTENTS OF THE EDUCATIONAL COMPONENT (CURRICULUM DISCIPLINES)

Topic. List of issues to be considered within the topic	Distribution in boundaries general time budget			Recommended literature2
	Auditor at work		Itself-stable work	
	Lk	Lab. with.		
Topic 1. Introduction. Safety rules and regulations work in the laboratory Rules of work in the laboratory, with reagents. Technical rules security Providing first aid. Acquaintance with laboratory dishes and other equipment. The simplest operations with substances		2	10	1,3,7,9

[1] It must correspond to the Matrix of ensuring the programmatic learning outcomes by the relevant components of the educational program, it is specified for the compulsory educational components of OP I and II level, for all (mandatory and selective OK) OP III

[2] A specific source from the main or additional recommended literature

Topic 2. Basic concepts and laws of chemistry. Basic concepts of atomic-molecular science: molecule, atom, chemical element, simple and complex substance, relatively atomic and molecular weights, mol, molar mass. Law of conservation mass and energy. Law of equivalents. Avogadro's law. Law constancy of the composition of chemical compounds. Chemistry in veterinary medicine.			10	2,6,8,12
Topic3. The structure of the atom and D. I. Mendeleev's periodic law. Chemical bond. Characteristics of the element by place in the periodic table. Periodic law. Structure of an atom: nucleus and electrons. Characteristics of the electron. Valence electrons. Core composition. Nucleon, neutron and proton number. Energetic level. Atom formulas: electronic, graphic. Schemes of atoms. Atom states: normal and excited. Energy and length chemical bond. The length of a chemical bond. Types of chemical connection Typical tasks and examples of their solutions.	2	2	10	15, 4, 7
Topic 4. Classification and nomenclature of inorganic compounds Oxides. Chemical properties and methods of obtaining oxides. Peroxides. Foundations. Chemical properties and methods getting the basics. Acids. Chemical properties and methods production of acids. Salt. Chemical properties and methods obtaining salts. Use and role in veterinary medicine.				1,8,12,4
Topic 5. Fundamentals of thermochemistry Thermochemistry. Thermodynamic process. Exothermic and endothermic processes. Thermal effect of the reaction. Standard thermal effect. Heat of combustion and formation. Standard conditions System: definition, classification, functions (enthalpy, entropy, Internal energy, Gibbs energy), heat capacity, parameters (pressure, mass, temperature, volume). The first, second and third laws of thermodynamics. Patterns of chemical reaction. Hess's law and its consequences. Law of Lavoisier and Laplace.			10	1,6,11,15
Topic 6. Speed of chemical reaction, influencing factors on her. Basic concepts of chemical kinetics. Speed chemical reaction, factors affecting it. Law of active masses - the basic law of chemical kinetics. Rate constant chemical reaction. The concept of activation energy, influence temperature on the reaction rate. Van't Hoff's rule. Concept of catalysis and its nature. Enzymes as catalysts of chemical processes.			14	13,7,9
Topic 7. Irreversible and reversible reactions. Chemical equilibrium. Equilibrium constant. Displacement of chemical equilibrium. Influence external factors on chemical balance. The principles of Le-Chatelier			8	21.3, 17.9
Topic 8. General concepts of oxidation-reduction processes. The degree of oxidation of an element in compounds. Typical oxidizers and restorers Change in redox properties of elements		2	8	22,18

depending on the structure of their atoms. Rules for composing equations redox reactions. Oxidative classification - reduction reactions.				
Topic 9. **Classification**redox reactions (intermolecular, intramolecular and disproportionation). The influence of environment on character course of the reaction. Redox processes in life body			10	23,2,8,16
Topic 10. General ideas about solutions Solution and its components (solute, solvent). Dispersed phase. Classification of solutions by degree dispersion, aggregate state (liquid, solid and gaseous) and the content of the reactant diluted, concentrated, saturated,saturated, unsaturated). Concentration of solutions (mass, molar, equivalent, molal). Mass fraction solute. Normality. Caption. Value of solutions for veterinary medicine.			14	17, 20, 6
Topic 11. Physical properties of solutions of non-electrolytes. The concept of solutions of electrolytes and non-electrolytes and theirs properties Osmotic pressure (Vant Hoff's law). Pressure of saturated solvent vapor above the solution (Raoult's first law). Boiling and crystallization temperature of solutions (II law Raul). Osmotic pressure of solutions. Solvent vapor pressure over the solution. Boiling and crystallization temperatures of solutions.			6	11, 15, 17
Topic 12. Electrolyte solutions. Electrolytic mechanism dissociation Quantitative characteristics of the dissociation process: degree and constant of electrolytic dissociation. Strong and weak electrolytes. Weak dissociation constantsof electrolytes, its relationship with the degree of dissociation. Reactions in solutions of electrolytes. Ionic reaction equations. Water is a weak electrolyte. Ionic product of water. Hydrogen and hydroxyl indicators. Methods of measuring pH. General information about indicators. Characterization of the environment of solutions with the help of pH. The essence of hydrolysis of salts. Types of salt hydrolysis. Constant and degree of hydrolysis of salts. Properties of electrolyte solutions. Theory of electrolytic dissociation. Ionic product of water. Hydrogen indicator. Hydrolysis of salts. Degree and constant of dissociation. Hydrolysis of salts.			10	22,7,13
Topic 13. Buffer solutions. Buffer system, buffer capacity, buffer values solutions Types of buffer systems. Buffer action. Value buffer solutions for the animal body.			12	10, 12, 16
Topic 14. Coordination compounds Complex (coordination) compounds. Classification. Nomenclature. Internal, External sphere Complex former. Ligands. Werner's theory. Coordination number. Coordination ties. Coordination capacity. The instability constant. Dissociation of complex compounds. The importance of coordination compounds for medicine (veterinary).			8	21,23,19
In total	**2**	**6**	**142**	

4. TEACHING AND LEARNING METHODS

DRN	**Teaching methods**(work to be carried out by the teacher during classroom classes, consultations)	**Number of hours**	**Teaching methods**(what types of educational activities should the student perform independently)	Number of hours
DRN 1. Understandthe chemical nature of physiological processes in the animal body with the participation of organic substances, which determines their subordination to basic chemical laws	*Explanatory and reproductive*methods: lecture, story-explanation, conversation, aimed at distinguishing the value-oriented content of the educational material (in the context of professional tasks) Using the platformMOODLE, PADLET, ZOOM during mixed learning.	20	work with textbooks, manuals, Internet materials; illustration, demonstration, performance of experiments, exercises, didactic tasks, independent works, etc	20
DRN 2. To establish the interrelationships of chemical and biological processes that occur in the body of animals in normal and pathological conditions	*Partial search methods*: problem-dialogue, modeling, case method, etc *Inductive methods*-related to the prediction of observations and experiments based on the data of experience Using the platformMOODLE, Google Meet, ZOOM during mixed learning.	20	independent search for educational information, performance of laboratory works of partial search content, complex didactic tasks and tasks.	20
DRN 3. To be able to use laboratory equipment and chemical reagents in compliance with the rules of their safe storage and use when conducting specialized research	*Visual methods*– demonstration of experiments *Practical methods*– working with reagents, laboratory dishes and devices in compliance with safety rules.	18	Preparation for the laboratory session, implementation and design of the report based on the results of the laboratory work	18
DRN 4. Formulate conclusions, recommendations, advice on the maintenance, feeding and treatment of animals or establish a diagnosis based on the obtained results of laboratory studies	*Deductive methods* -related to wordinggeneral provisions, formulas, laws and their application to specific tasks.*Inductive methods*-related to the prediction of observations and experiments based on the data of experience	18	Reading the literature on the topic, preparation for the laboratory session, execution and design of the report based on the results of the laboratory work	16

5. EVALUATION BY THE EDUCATIONAL COMPONENT

5.1. Diagnostic assessment (specified as necessary)

5.2. Summative assessment

5.2.1. To assess the expected learning outcomes, it is provided

No	Methods of summative assessment	Points / Weight in the overall assessment	Compilation date
1.	Compilation of comprehensive written control	(3x15) points /45%	7, 10, 14 weeks
2.	Report on the performance of laboratory work	*25 points / 25%*	up to 14-15 weeks
3.	Final control: exam	*30 points / 30%*	Exam week

5.2.2. Evaluation criteria

Component[1]	**Unsatisfactorily**	**Satisfactorily**	**Fine**	**Perfectly**[2]
Compilation of a comprehensive written thematic control (3 papers)	*<5 points*	*5-8 points*	*9-12 points*	*13-15 points*
	An abbreviated condition of the problem has been formulated, there are no reaction equations and formulas	An abbreviated condition of the problems was made, calculations were performed only according to the ready-made formula	The necessary formulas of substances and reaction equations are given, the solutions of the problems contain errors	The tasks are completed in full, the presentation is logical and rational, the conclusions and generalizations are well-argued
Report on the performance of laboratory work	*<5 points*	*6-15 points*	*16-22 points*	*23-25 points*
	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 weakly argued, there are mistakes made in them	there are minor flaws in the presentation of the material, the presentation is not sufficiently systematized, there are some inaccuracies in the conclusions and generalizations	the material is presented in full, the presentation is logical, the conclusions and generalizations are reasoned
Final control: exam	<14 points	15-20	21-26	27-30
	The issues of the ticket are not disclosed	No more than two tasks are revealed	No more than three tasks are revealed	Three tasks are revealed and a practical solution is proposed

[1]Specify the summative assessment component

[2]Specify the distribution of points and the criteria determining the level of assessment

5.3.Formative assessment:

To assess the current progress in learning and understand the directions for further improvement is provided

No	**Elements of formative assessment**	**Date**
1	Interactive testing to check the assimilation of the lecture material	10 minutes at the beginning of the laboratory session
2	Checking of individual homework, discussion with the teacher and self-correction of the work done by students	Within a week of execution
3	Survey and teacher's oral comments based on his results	weekly
4	Checking the results of experiments for laboratory works with feedback	Within a week of execution

6. EDUCATIONAL RESOURCES (LITERATURE)

6.1 Main sources

5.3.1. Textbooks and manuals

1. Veterinary clinical biochemistry: textbook / V.I. Levchenko and others. under the editorship V.I. Levchenko and V.V. got in 2nd ed., revision. and additional Bila Tserkva, 2019. 416
2. Organic chemistry / Snitinskyi V.V., Fedevich E.V., Solovodzinska I.E., Shkumbatyuk R.S., Vishurt O.I. — Lviv: SPOLOM, 2016. — 300 p
3. Organic chemistry. Practicum: teaching manual for agricultural studies closing III-IV levels of accreditation with special "Veterinary medicine", "Zooengineering", "Agronomy" / O. I. Kononskyi. - K.: Higher school, 2002. - 248 p.
4. Biochemistry. Workshop/ L.I. Ostapchenko, I.V. Kompanets, O.V. Skopenko et al.. - K.: Publishing and Printing Center *Kyiv University*, 2018. - p.296
5. Biochemistry short course. Part 1. / Z.M. Skorobagatova, M.A. Stashkevich, A.H. Matvienko. - Biocomposite, 2021. - 148 p.
6. Chemistry. Part I. General, inorganic and analytical chemistry. Laboratory practice. Fedyshyn B.M. et al./Ed. Fedyshin B.M. Zhytomyr: Volyn, 2004. 300p.
7. Babko A.K., Pyatnytskyi I.V. Quantitative analysis. - K.: Higher school,-1974-351 p.
8. Burya O.I. and others. Workshop on bioinorganic chemistry.-Dnipropetrovsk: January, 1998.-115p.
9. Zinchuk V.K., Huta O.M. Chemical methods of qualitative analysis. - Lviv.: Publ. center of LNU named after I. Franka, - 2006 - 151 p.
10. Karnaukhov O.I., Melnychuk D.O., Chebotko K.O., Kopilevich V.A. General and bioinorganic chemistry. Kyiv.: Phoenix, 2001. 578 p.
11. Karnaukhov A.I., Beznys A.T. Bioinorganic chemistry:-K.: Higher school, 1992.-224p.
12. Kuzma Yu., Lomnytska Ya., Chaban N. Analytical chemistry. - Lviv.: Publ. center of LNU named after I. Franka, - 2001 - 298 p.
13. Savitsky I.V. Bioinorganic chemistry:-K.: Higher school, 1992.-471p. Lurie Yu.Yu.
14. Romanova N.V. General and inorganic chemistry. Kyiv.: Irpin, VTF "Perun", 1998. 480 p.

5.3.2. Methodical support

15. **Morozov B.S.** Bioinorganic and analytical chemistry. Methodical instructions for conducting laboratory-practical classes. Methodical guidelines for full-time students of the Faculty of Veterinary Medicine of Sumy. 2023. - 33 p.
16. **Morozov B.S.** Bioorganic and analytical chemistry "Methodical guidelines for laboratory work". Methodical guidelines for full-time students of the Faculty of Veterinary Medicine of Sumy. 2023. - 25 p.

5.4. Additional sources

17. T.V. Koval Biochemistry of animals: a study guide [learning. manual for students in the fields of "Technology of production and processing of livestock products" and "Veterinary medicine"] / T.V. Koval, O.V. Ovcharuk – Kamianets-Podilskyi: D.G. Zvoleyko Publishing House, 2016. – 440 p.
18. Kravchenko M.Y., Ivchenko V.D. Organic chemistry: methodological instructions for performing laboratory work for students of the 1st year of specialties 211 "Veterinary Medicine", 212 "Veterinary Hygiene, Sanitation and Expertise" of the Master's degree. – Sumy, 2021. – 36 p.
19. Kravchenko M.Y., Ivchenko V.D. Organic chemistry. Methodological guidelines for independent study of the "Theoretical Foundations of Organic Chemistry" module by students of the 1st year of specialties 211 "Veterinary Medicine" and 212 "Veterinary Hygiene, Sanitation and Expertise" of the Master's degree - Sumy: SNAU, 2021. - 37 p.
20. Kravchenko M.Y., Ivchenko V.D. Organic chemistry. Part 1. Hydrocarbons: synopsis of lectures for students of the 1st year of specialties 211 "Veterinary Medicine", 212 "Veterinary Hygiene, Sanitation and Expertise" of the Master's degree. – Sumy, 2021. – 51 p.
21. Nomenclature of organic compounds: study guide / V.S. Tolmacheva, O.M. Kovtun, O.A. Dubovik and others. – Ternopil: Mandrivets, 2014 – 12 p.
22. Organic chemistry. Tests with explanations: teaching. manual O-64 for students. higher education closing / V. P. Chernykh, L. A. Shemchuk, T. O. Kolesnikova, etc.; under the editorship V. P. Chernykh. - 3rd ed., stereotype. - Kh.: National University of Applied Sciences, 2017. - 460 p.
23. Pharmaceutical chemistry: a textbook (University I-III year) / H.P. Nizhnyk — 2nd ed., edition, K: V-vo "Medytsina", 2015. — 352 p.

6.2. Software

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

Addition

Review of the Work Program (syllabi)

The parameter by which the work program (syllabus) of the educational component is evaluated by the guarantor or member project group	So	No	Comment
Learning outcomes for the educational component (DRN) correspond to the NRC			
The results of the study by the educational component (DRN) correspond to the prescribed PRN (for mandatory OKs)			
Learning outcomes by educational component provide an opportunity to measure and evaluate the level of their achievement			

Member of the project group OP 21 Veterinary medicine Shkromada O.I. _____
(name) (surname) (signature)

The parameter by which the work program (syllabus) of the educational component is evaluated by the teacher of the corresponding department	So	No	Comment
General information about the educational component is sufficient			
Learning outcomes for the educational component (DRN) correspond to the NRC			
The results of training according to the educational component (DRN) provide an opportunity to measure and evaluate the level of their achievement			
Learning outcomes (LRE) refer to students' competencies, not the content of the discipline (contain knowledge, skills, abilities, and not the topics of the discipline's curriculum)			
The content of the OK is formed in accordance with the structural and logical scheme			
Educational activity (teaching and learning methods) enables students to achieve the expected learning outcomes (LEIs)			
The educational component involves learning through research that is appropriate and sufficient for the relevant level of higher education			
The assessment strategy within the educational component is in accordance with University/faculty policy			
The provided assessment methods make it possible to assess the degree of achievement of learning outcomes by educational component			
The workload of students is adequate to the volume of the educational component			
The recommended learning resources are sufficient to achieve the learning outcomes (LEOs)			
The literature is relevant			

Reviewer (teacher)
Reviewer (teacher)

_____

(name) (position, full name) (signature)