



MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

State Biotechnological University

Educational and scientific institute/faculty

faculty of veterinary medicine

(the name of the educational and scientific institute/faculty)

"Approved"

The head of the department

internal diseases and clinical

diagnosis of animals

(name of department)

(O.V. Matsenko)

(signature)

(full name)

"__20__"__June__2025 y.

Department of "internal diseases and clinical diagnosis of animals"

(name of department)

WORK PROGRAM

OF EDUCATIONAL DISCIPLINE

"Veterinary clinical biochemistry"

(code and name of the academic discipline)

Level of higher
education

second

(name)

Field of study

21 Veterinary medicine

(code and name)

Specialty

211 Veterinary medicine

(code and name)

Educational program

Veterinary medicine

(name)

for students of the 4th year (admission based on
complete general secondary education)

English language of education

Kharkiv – 2025

Compilers: candidate of veterinary sciences, associate professor Vikulina G.V.

(academic title, position, surname and initials)

The working program of the academic discipline was approved at an extended meeting of the department " internal diseases and clinical diagnosis of animals "
(name of department)

Protocol from: " 20 " June 2025 year № 13

The work program has been agreed

Guarantor of the educational program "Veterinary medicine" _____
(name of EPP)

« 23 » June 2025 year (_____) _____ S.V. Naumenko _____
(signature) (full name)

The validity period has been extended to:

" _____ " _____ 20 ____ p. protocol № _____ from " _____ " _____ 20 ____ y.
head of department _____ (_____)
(name of department) (signature) (full name)

" _____ " _____ 20 ____ p. protocol № _____ from " _____ " _____ 20 ____ y.
head of department _____ (_____)
(name of department) (signature) (full name)

" _____ " _____ 20 ____ p. protocol № _____ from " _____ " _____ 20 ____ y.
head of department _____ (_____)
(name of department) (signature) (full name)

1 Description of the academic discipline

Name of indicators	Characteristics of the academic discipline					
	full-time education		external form of education			
Number of credits <u>5</u>	Discipline status:					
	<u>mandatory/optional</u>					
Sections - <u>2</u>	Year of study:					
		<u>4</u>				
	Semester					
The total number of hours <u>150</u>		<u>8</u>				
	Lectures					
	__ hours	<u>14</u> hours	__ hours	__ hours		
	Practical (seminar)					
	__ hours	__ hours	__ hours	__ hours		
	Laboratory					
	<u>44</u> hours		__ hours			
	Independent work					
Weekly hours for full-time education: classrooms – <u>58</u> ; independent work of the acquirer – <u>92</u>	Type of control:					
	_____	the assessment is differentiated	_____	_____		

2. The purpose and tasks of the discipline

The purpose of the discipline is to provide students with the necessary theoretical knowledge and practical skills and abilities on the techniques of obtaining and preparing for research biological material obtained from animals, for conducting biochemical studies, extracting biochemical indicators and their further interpretation.

The task of studying the discipline consists in familiarizing students with the peculiarities of biochemical transformations in the body during pathology; elucidation of the subject, object of biochemistry of tissues, organs and systems in normal and pathological conditions; familiarization with the main methods of development of veterinary clinical biochemistry; in learning to interpret the data of biochemical research.

The subject of study of the academic discipline is the necessary theoretical knowledge and practical skills on the technique of obtaining biological material and preparing it for biochemical research, the selection of biochemical indicators and their subsequent interpretation.

The basic disciplines for successful assimilation of the program material of the discipline are (from the structural and logical scheme of the educational program for mandatory disciplines) "Animal biochemistry", "Pathological physiology", "Clinical diagnosis of animal diseases"

This educational discipline ensures the formation of the following program learning outcomes: (from the educational program for mandatory disciplines)

PLO1. Know and correctly use the terminology of veterinary medicine.

PLO2. Use information from domestic and foreign sources to develop diagnostic, treatment and business strategies.

PLO3. Determine the essence of physico-chemical and biological processes that occur in the body of animals in normal and pathological conditions.

PLO5. To establish a connection between the clinical manifestations of the disease and the results of laboratory studies.

3. Program of educational discipline

Chapter 1 - General Veterinary Clinical Biochemistry

Topics "Objects and methods of research in veterinary clinical biochemistry."

Violation of the metabolism of carbohydrates, lipids and proteins in the pathology of the internal organs of animals of various species. Clinical biochemistry of water-ion, vitamin and mineral exchanges. Carcinogenesis"

Brief content of the topic - Methods of obtaining and preparing for research biological fluids of the animal body. Species, breed and age characteristics of biochemical indicators in healthy animals and their dependence on physiological state, type of feeding and productivity. Biochemical methods of diagnosis of disorders of carbohydrate, lipid and protein metabolism, as well as control over their recovery. Violation of water-ion exchange in case of diseases of internal organs of animals. Dehydration and hyperhydration. Violation of acid-base balance, exchange of macro- and microelements and vitamins in case of animal diseases. Biochemical changes in the case of neoplasms.

Recommended reading [1,5,6,8,11,12]

Chapter 2 - Special veterinary clinical biochemistry

Topics "Clinical enzymology. Changes in biochemical parameters due to pathologies of internal organs and systems"

Brief content of the topic - Main directions of veterinary enzymology. Non-specific and specific (indicator, marker) enzymes of organs and tissues. Biochemical diagnosis of the most common nosological forms of diseases of the cardiovascular, respiratory, digestive and excretory systems. Interpretation of the results of biochemical research of biological substrates

Recommended reading [2,3,4,9,10,11,12]

4 The structure of the academic discipline

Name sections and topics	Number of hours					
	Full-time					
	The total amount	classrooms			Independent work	
		everything	including			
	lectures		laboratory	practical		
1	2	3	4	5	6	7
Chapter 1 General veterinary clinical biochemistry						
Topic 1 - Introduction. Research objects and methods in veterinary clinical biochemistry	10	6	2	4	0	4
Topic 2 - Violation of protein metabolism in case of pathology of internal organs of animals	8	8	2	6	0	0
Topic 3 - Violation of carbohydrate metabolism in case of pathology of internal organs of animals	6	6	2	4	0	0
Topic 4 - Violation of lipid metabolism in case of pathology of internal organs of animals	4	4	2	2	0	0
Topic 5 - Violation of water-ion exchange and acid-base balance in case of animal diseases	18	6	2	4	0	12
Together for section 1	46	30	10	20	0	16
Chapter 2 Special veterinary clinical biochemistry						
Topic 6 - Clinical enzymology	6	6	2	4	0	0
Topic 7 – Biochemical studies in diseases of the heart and lungs	4	4	0	4	0	0
Topic 8 - Biochemical studies in diseases of the liver and biliary tract	22	6	2	4	0	16
Topic 9 - Biochemical studies in diseases of the urinary system	4	4	0	4	0	0
Topic 10 – Peculiarities of the approach to the interpretation of biochemical research results	68	8	0	8	0	60
Together by section 2	104	28	4	24	0	76
Hours in general	150	58	14	44	0	92

5. Theoretical lessons (lectures)

3. Theoretical lessons (lectures)		
№	Name of the subject of the lesson	Number of hours
		full-time
Chapter 1 General veterinary clinical biochemistry		
1	Research objects and methods in veterinary clinical biochemistry	2
2	Violation of protein metabolism in case of pathology of internal organs of animals	2
3	Violation of carbohydrate metabolism in case of pathology of internal organs of animals	2
4	Violation of lipid metabolism in case of pathology of internal organs of animals	2
5	Violation of water-ion exchange and acid-base balance in case of animal diseases	2
Chapter 2 Special veterinary clinical biochemistry		
6	Clinical enzymology	2
7	Biochemical studies in diseases of the liver and biliary tract	2
	Together	14

6. Laboratory classes

№	Name of the subject of the lesson	Number of hours
		full-time
Chapter 1 General veterinary clinical biochemistry		
1	Organization of biochemical research in veterinary medicine	4
2	Biochemical study of indicators of protein metabolism	4
3	Biochemical study of indicators of non-protein nitrogenous components	2
4	Biochemical study of indicators of carbohydrate metabolism in pathologies	2
5	Diabetes mellitus: diagnostic criteria	2
6	Biochemical study of indicators of lipid metabolism in pathologies	2
7	Violation of the metabolism of macro- and microelements in case of animal diseases	2
8	Clinical vitaminology	2
Chapter 2 Special veterinary clinical biochemistry		
9	Enzyme diagnosis	4
10	Veterinary clinical biochemistry in case of heart diseases	2
11	Veterinary clinical biochemistry in the case of lung diseases	2
12	Veterinary clinical biochemistry in the case of diseases of the gastrointestinal tract and pancreas	2
13	Biochemical studies in diseases of the liver and biliary tract	2
14	Veterinary clinical biochemistry in the case of pathology of the urinary system	4

15	Peculiarities of interpreting the results of biochemical studies of biological substrates	8
	Together	44

7. Independent work

№	Name of topic	Number of hours
		full-time
Chapter 1 General veterinary clinical biochemistry		
1	Characteristics of physicochemical methods in clinical biochemistry	4
2	Violations in the exchange of some trace elements	4
3	Disorders in the metabolism of some vitamins. Vitamin-like substances	8
Chapter 2 Special veterinary clinical biochemistry		
4	Hormones of the gastrointestinal tract	6
5	Rumen functioning disorders (lactic acidosis, rumen tympany, urea poisoning)	10
6	Individual work with the results of a biochemical study of biological material obtained from an animal with internal pathology. Describing and summarizing existing changes in blood biochemical indicators and provides a conclusion	60
	Together	92

8. Teaching methods

(According to the structure of the academic discipline)

1. Lectures.
2. Laboratory classes.
3. Self-study.

* The content of the section is of a recommendatory nature and is adjusted according to the content of the academic disciplines.

9. Control methods

- ❖ oral interview;
- ❖ test control;
- ❖ credit;
- ❖ exam.

During the current and final control, the means of assessing the results of learning in the discipline are standardized computer tests.

The final semester control (credit) is determined by the sum of the actually scored rating points from the current control and the individual educational and research task.

Current control is carried out during the semester by means of a survey (oral or test), as well as checking the quality of mastering the topics of independent work.

When choosing the criteria for assessing the assimilation of the discipline

program by the applicant, the implementation of the program and the assimilation of the material in terms of lecture and laboratory classes, as well as the implementation of the independent work provided for by the program, were taken into account.

All types of control (oral interview, written interview, test interview) are closely related and organized in such a way as to stimulate the effective independent work of applicants and ensure an objective assessment of the level of their knowledge.

After completing the study of the discipline (part of the discipline), the final control is carried out in the form of an exam (test) and the applicant can score from 60 to 100 points inclusive during the semester at the control points.

**The content of the section is of a recommendatory nature and is adjusted in accordance with the content of the academic discipline.*

10. Distribution of points received by students

Current testing and independent work			Total points
Section	Section	$((T_1+T_2+...+T_{10})/n) \times 60\%$ $AD \times 40\%$	Overall rating score (ORS = S+AD) 0-100
T1-5	T6-10		
0-100	0-100		

T₁, T₂... T₁₀ – topics of sections.

The grade that a higher education applicant receives for conducting an intermediate (current) control (CurC) consists of the points that the applicant receives during testing (T), which are 30%; the points that the applicant receives during activity in classes (Cl), which are 40%; and the points for mastering the independent work block (InW), which are 30%.

$$\text{CurC} = T \times 0,3 + Cl \times 0,4 + InW \times 0,3$$

In each section of the educational component, current control is carried out (**current control** - CurC).

For applicants in the fall (spring) semester, when the final knowledge test is completed with an undifferentiated credit (UDC), the final sum of points (UDC points) is the arithmetic average of the points of the four current tests of the fall (spring) semester:

$$\text{UDC points} = (\text{CurC } 1 + \text{CurC } 2) / 2$$

Based on the results of the semester control, the applicant's transcript is assigned a "pass/fail" grade on the national scale.

The final control of the academic performance of applicants is carried out in the form of an exam based on the results of computer testing. The exam grade for the educational component (discipline) is determined on a 100-point scale.

The exam grade (EG) is 40% of the total final grade (FG).

$$\mathbf{EG = ETS \times 0,4}$$

where: ES – exam score; ETS– exam testing scores, which account for 40% of the points scored during exam testing.

The final grade for the discipline is given on a 100-point scale. It is calculated as the average arithmetic value (AAV) of all the grades received by the student from the current control (CurC) of the assimilation of the material of the sections, with their subsequent conversion into points according to the following formula:

$$\mathbf{AAV = (CurC\ chapter1 + CurC\ chapter.2) / 4}$$

$$\mathbf{CurCS = AAV \times 0,6}$$

where: CurCS – current control scores, which make up 60% of the total final score; AAV is the arithmetic average value of all grades received by the student from the current control

The applicant can score up to 60 points inclusive at the control points of the mastery of the sections within 2 semesters.

Thus, the final grade (FG) is calculated using the formula:

$$\mathbf{FG = EG + CurCS}$$

The results of the tests are displayed in the DBTU Moodle system. All forms of control are included in the 100-point assessment scale.

11. Scale: national and ECTS and criteria assessment to determine the level of knowledge and skills

The control of students' knowledge and skills in the discipline is carried out in accordance with the use of the European system of transfer and accumulation of ECTS credits.

Basic provisions:

The total number of current control measures that a student must pass in the discipline is determined taking into account the number of credits in the discipline.

Based on the results of the current control measure, the student's level of assimilation of the educational material is assessed according to the national scale and the ECTS scale.

The number of points received by the student in the assessment of the final control is correlated with the marks on the national scale and the ECTS scale in accordance with Table

1. Rating scale

<i>100-point scale</i>	National scale	interpretation	ECTS scale
90 – 100	excellent	Excellent - excellent answer, the work is fulfilled with only a small number of errors	A
82 – 89	good	Very well - above average with a few errors	B
74 – 81		Well - in general the correct answer, the work with a certain number of serious errors	C
64 – 73	satisfactory	Satisfactorily – not bad, but with big number of errors	D
60 – 63		Quite satisfactorily – the work meets the minimum criteria	E
35– 59	unsatisfactory	Unsatisfactorily – with the possibility to pass again	FX
0-34		Unsatisfactorily – with compulsory passing of the work once again	F

Passing current tests is mandatory. A section is considered passed if the student has scored the minimum required number of points or more.

The results of the rating for the section are brought to the attention of students no later than the third working day after the control event and, in the absence of claims from the students, are considered final.

If the student does not agree with the decision to assign him rating points for the section, then he must immediately after their announcement file a written appeal to the head of the department and, within the specified period, take an oral attestation for the section before the commission. The composition of the appeal commission in each specific case is determined by the head of the department. The decision of the commission is final.

A student who did not appear for the current test has the right to take the missed current test during the assessment week.

The final rating of current performance in the discipline is calculated by averaging the ratings from all sections. The semester grade is given to the student taking into account the results of the final and current tests. The maximum number of points that a student can receive when studying a discipline is 100.

The exam involves a final test. If permission is granted for automatic exam enrollment, a student who has passed all current tests on time and has been certified with an "excellent" grade based on their results can receive a credit automatically. The semester grade in this case is the average grade for the sections.

The teacher is required to submit the completed credit and examination report to the academic department within the following deadline: for the exam - no later than the next business day after its completion.

The mastery of the independent work block is assessed on a scale according to the following regulations (Table 2)

Table 2.

Assessment criteria (100-point system, oral interview).

The level of formation of a student's knowledge and skills in the academic discipline, both during the final and current control, is assessed on a 100-point scale with subsequent conversion of grades into the national scale and the ECTS grading scale.

No	Criteria	Maximum number of points	Description
1	Completeness of the answer	30 points	The answer covers all the main aspects of the question, reveals its content in accordance with the curriculum.
2	Correctness and accuracy of presentation	20 points	The answer does not contain factual, logical or terminological errors.
3	Consistency and logic	10 points	The answer is logically structured, without inconsistent or chaotic fragments.
4	Language and style of presentation	10 points	The expression is competent, clear, using professional terminology.
5	Independent thinking	10 points	The student demonstrates the ability to draw his own conclusions, analyze, compare, give examples.
6	Additional knowledge (outside the main program)	10 points	The answer contains references to modern sources, interdisciplinary connections, and the latest data.
7	Ability to answer additional questions	10 points	The student confidently responds to the teacher's clarifying or in-depth questions, provides additional arguments or examples.

The conversion of grades on a 100-point scale to the national scale and ECTS scale is carried out according to the table:

Total points for all types of learning activities	Mark according to ECTS scale	Mark according to national scale
90 – 100	A	excellent
82 – 89	B	good
74 – 81	C	

64 – 73	D	satisfactory
60 – 63	E	
35 – 59	FX	unsatisfactory
0 – 34	F	

Activity in classes is assessed on a scale with a maximum of 100 points in accordance with the following regulations (Table 3)

Table 3.

ACTIVITY ASSESSMENT SCALE IN CLASSES

ECTS scale	National scale	Points	Score interpretation
A	Excellent	90-100	the student works actively during classes, provides complete answers to the teacher's questions and shows a deep mastery of the material, is able to express his own opinion when discussing situational tasks, demonstrates the ability to independently and reasonably present the material, analyze phenomena and facts, make independent generalizations and conclusions, correctly completes educational tasks, has a full synopsis of theoretical material, regularly visits the Moodle system
B	Very well	82-89	the student works actively during the lessons, the questions are covered in full, the presentation of the material is logical, substantiated by facts, with references to literary sources, the coverage of the questions is completed with conclusions, the student has shown the ability to analyze facts and events, as well as to complete educational tasks. However, there are inaccuracies in the answers, some minor errors, the presence of a full summary of the theoretical material, regular visits to the Moodle system
C	Well	74-81	the student works actively during the lessons, the questions are covered in full, the presentation of the material is logical, substantiated by facts, with references to literary sources, the coverage of the questions is completed with conclusions, the student has shown the ability to analyze facts and events, as well as to complete educational tasks. However, there are inaccuracies in the answers, some minor errors, there is insufficient reasoning

			when presenting the material, there is an incomplete synopsis of the theoretical material, partial access to the Moodle system
D	Satisfactorily	64-73	The student has generally mastered the essence of the issues on the topic, demonstrates knowledge of the lecture material and educational literature, tries to analyze facts and events, draw conclusions and solve situational problems. However, in class he behaves passively, responds only to the teacher's call, gives incomplete answers to questions, makes gross mistakes when covering theoretical material, incomplete notes on theoretical material, partial access to the Moodle system
E	Quite satisfactorily	60-63	the student lacks understanding of the main essence of the questions, conclusions, generalizations, demonstrated inability to solve situational problems, incomplete note-taking of theoretical material, partial access to the Moodle system
FX, F	Unsatisfactorily	0-59	lack of desire to participate in the discussion of issues, lack of notes, irregular visit to the Moodle system

Example: a student wrote the test tasks of the current control for 85 points. Multiply by 0.3. The result for the tests is 25.5 points. For independent work, the student received 88 points. Multiply by 0.3. The result for it is 26.4 points. For activity in classes - the student received 74 points. Multiply by 0.4. We get 29.6. In total, the number of points for the current control is 81.5 points. We average towards a larger number and get 82 points, which is equal to good B.

Regarding the final certification of the student, the result obtained for the student's current work (average value for 4 sections, multiplied by 0.6) and the final test work (multiplied by 0.4) is taken into account.

Example: Section I – 83 points, Section II – 95 points, Section III – 73 points, Section IV – 88 points. The sum of the points for the sections is $339 / 4 = 84.75$ (85) points – this is the average value. Next, $85 \times 0.6 = 51$ points. The student wrote the final exam with 91 points. $91 \times 0.4 = 36.4$ points. Therefore, the total number of points for the discipline is $51.0 + 36.4 = 87.4$. We average towards a smaller number and get 87 points, which is equal to a good or B grade.

12. Methodological support

1. Textbook for veterinary clinical biochemistry / Vikulina G.V., Borovkov S.B. – Kh., 2022. – 104 p.
2. Chatterjea MN, Shinde Rana/ Textbook of medical biochemistry [eighth edition]. – Jaypee Brothers Medical Publishers, 2012. – 894 p.

3. Bellwood, Brianne. Veterinary technician's handbook of laboratory procedures / Brianne Bellwood, Melissa Andrasik-Catton, 2014. – 201 p.

Material and technical support

Code	The name of the technical (instruments, tools, reagents) of the training facilities
T-1	Syringes, needles for taking blood, catheters, probes, laboratory utensils, heparin, sodium citric acid, thymol crystalline, water bath, thermostat, centrifuge, photoelectrocolorimeter, biochemical semiautomatic analyzer
T-2	Sets of dishes and reagents for determination of biochemical parameters in stabilized blood, serum (plasma), protein-free filtrate
T-3	Sets of utensils and reagents for determination of biochemical indices in urine
T-4	Tables Multimedia support
T-5	Results of biochemical studies of blood and urine
T-6	Folders with illustrative and demo material

13. Recommended Books

1. Kaneko J., Harvey J., Bruss M. Clinical Biochemistry of Domestic Animals, 6th Edition. – Academic Press, 2008. – 928 p.
2. Squires E. James. Applied animal endocrinology. - CABI Publishing, 2003. – 252 p.
3. Atlas of comparative diagnostic and experimental hematology / Clifford Smith and Alfred Jarecki; foreword by Harold Tvedten. – 2nd ed. 142 p.
4. David L. Panciera, Anthony P. Carr. Endocrinology for the small animal practitioner. – Teton NeewMedia, 2005. – 195 p.
5. Kerr M.G. Veterinary laboratory medicine: clinical biochemistry and haematology. – John Wiley & Sons, 2008. – 386 p.
6. Harvey J.W. et al. Clinical biochemistry of pregnant and nursing mares //Veterinary clinical pathology. – 2005. – T. 34. – №. 3. – C. 248-254.
7. Kramer J.W., Hoffmann W.E. Clinical enzymology //Clinical biochemistry of domestic animals. – Academic Press, 1997. – C. 303-325.
8. Radostits O.M. et al. Veterinary clinical examination and diagnosis. – WB Saunders, 2000.
9. Cerón J.J. et al. The effects of different anticoagulants on routine canine plasma biochemistry //The Veterinary Journal. – 2004. – T. 167. – №. 3. – C. 294-301.
10. Newsholme, E. A. Functional biochemistry in health and disease / Eric Arthur Newsholme and Tony R. Leech, 2010. – 561 p.
11. Rosenthal, Miriam D. Miriam D. Rosenthal and Robert H. Glew. Medical biochemistry: Human metabolism in health and disease, 2009. – 439 p.
12. N. Mallikarjuna Rao. Medical Biochemistry. – New Age International Publishers, 2006. – 838 p.

14. Electronic information resources*(Links)*

<http://moodle.btu.kharkiv.ua/course/view.php?id=425>

15. Changes and additions*(to methodological support and recommended literature)*

What is removed from the work program	What is entered in the work program	Date of consideration by the department