

**NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES
OF UKRAINE**

Department of Biochemistry and Animal Physiology named
after academician Maxim Hulyi



«**CONFIRMED**»

Dean of the Faculty of Veterinary
Medicine

M. Tsvilikhovskyi
2023

«**APPROVED**»

at the meeting of the department of biochemistry and
animal physiology named acad. Maxim Hulyi

Protocol №8 18.04.2023

Head of Department

V. Tomchuk

” **REVIEWED** ”

Program Coordinator Veterinary
Medicine

N. Grushanska

PROGRAM OF THE COURSE

Veterinary clinical biochemistry

Specialization 211 – "Veterinary Medicine"

Educational program Veterinary Medicine

Faculty: Veterinary Medicine

Developers:

Doctor of Vet Sciences, Prof. V. Tomchuk

Ph.D., Assoc. Prof. V. Tsvilikhovskyi

Doctor of Vet Sciences, Prof. V. Grishchenko

Kyiv – 2023

1. Description of the course

Veterinary clinical biochemistry

Field of knowledge, specialization, educational program, educational degree	
Education degree	Master
Specialization	211 Veterinary Medicine
Educational program	Veterinary Medicine
Characteristics of the course	
Type	Compulsory/elective
Total number of hours	120
Number of ECTS credits	4
Number of content modules	2
Course project (work) (if applicable)	-
Form of assessment	Credit
Descriptions of the course	
	full-time education
Cours (year of study)	4
Semester	7
Lecture classes	15 hr.
Practical, seminar classes	hr.
Laboratory classes	45 hr.
Individual assignments	60 hr.
Number of weekly classroom hours for full-time students form of study	4 hr.

2. Purpose, objectives, and competencies of the course

Purpose of the course – to give students the necessary theoretical knowledge and practical skills for obtaining equipment and learning diverse biological material obtained from sick animals for clinical and biological research and laboratory analysis, including for a correct interpretation of the results of these studies.

Objectives of the course. A study of the course the student should:

- **know** the features of biochemical processes in the body during different animal diseases and indicators that characterize them, to understand the molecular mechanisms of pathogenesis of many diseases of various etiologies;
- **be able to** receive a variety of biological material, conduct necessary laboratory tests and among a large number of laboratory methods to select the most informative measure the effectiveness of drugs and the degree of recovery processes in the affected tissues and organs and to interpret the obtained results, comparing them with the symptoms of disease.

Acquisition competencies:

Integrated competency (IC):

Ability to solve complex tasks and problems in the industry of veterinary medicine, which involves carrying out research and/or implementation of innovations and is characterized uncertainty of conditions and requirements.

General competencies (GC):

1. Ability to abstract thinking, analysis and synthesis.
2. Ability to apply knowledge in practical situations.
3. Knowledge and understanding of the subject area and profession.
4. Ability to communicate in the state language both orally and in writing.
5. Ability to conduct research at the appropriate level.
6. Ability to make informed decisions.
7. The desire to preserve the environment.

Professional (special) competencies (PC):

1. Ability to use tools, special devices, instruments, laboratory equipment and other technical means to carry out the necessary manipulations during professional activities.
2. Ability to follow the rules of labor protection, asepsis and antiseptics during professional activities.
3. Ability to take, pack, record and send samples of biological material for laboratory research.
4. Ability to organize and conduct laboratory and special diagnostic tests and analyze their results.

5. Ability to apply knowledge of biosafety, bioethics and animal welfare in professional activities.
6. Ability to develop and implement measures to protect the population from diseases common to animals and humans.
7. Ability to protect the environment from contamination by livestock waste, as well as materials and veterinary products.
8. Ability to use specialized software to perform professional tasks.
9. Ability to organize, implement and control the flow of documents during professional activities.

Program learning outcomes (PLO):

Attestation is carried out in the form of a single state qualifying exam.

3. The program of the course and structure of the course

Content module 1. General veterinary clinical biochemistry

Lecture 1. Objects and methods in clinical biochemistry.

Methods of preparation for examination of blood, urine, saliva, rumen contents, digestive juices, bile, cerebrospinal fluid, synovial fluid and other biological fluids domestic and farm animals; puncture and aspiration, liver biopsy, methods of producing bile.

Characterization of physical and chemical methods of clinical biochemistry. Instrumentation.

Species, breed and age characteristics of biochemical parameters (blood, urine, cerebrospinal fluid, digestive juices, saliva, etc..) in healthy animals and their dependence on the physiological state, such as feeding and performance. Internatsionapna system of units SI (SI) in clinical laboratory diagnosis.

Modern methods of mathematical processing of the results.

Lectures 2. Disorders of protein metabolism in case of diseases of the internal organs of animals.

Disorders of protein homeostasis. Hypo- and albuminosis, dysproteinemia, paraproteynemiya and proteinuria, the etiology of their occurrence. Clinical interpretation of the definition of total protein and protein fractions. Colloid-sediment samples and their importance in the diagnosis of metabolic proteins in the pathology of liver and other organs. Biochemical methods of diagnosing of protein metabolism diseases in the body and control its recovery.

Methods and clinical diagnostic values of determination in blood and urine components of residual nitrogen: urea, alternating nitrogen, uric acid, ammonia, creatine, creatinine, indican and others. Azotemia: relative and absolute, productional and retention.

Lecture 3. Laboratory diagnosis of disorders of carbohydrate metabolism in the case of diseases of the internal organs of animals.

Disorders of intermediate metabolism of carbohydrates: synthesis and breakdown of monosaccharides, oligosaccharides, glycogen. Gluconeogenesis and

its disorders. Hypo- and hyperglycemia, glucosuria, and fruktosuria, galactosuria and their clinical interpretation. Metabolic disturbances heteropolysaccharides.

Disorders of intermediary metabolism of lipids in the case of intestinal diseases, liver and pancreas. Obesity. Lipomobilization syndrome. Fatty liver, atherosclerosis. Ketogenesis and its disorders. Indicators of lipid peroxidation and antioxidant defense system of the body.

Biochemical methods of diagnosing disorders of lipid metabolism and control of its recovery.

Lectures 4. Laboratory diagnosis of lipid metabolism disorders in the case of diseases of the internal organs of animals.

Disorders of intermediary metabolism of lipids in the case of intestinal diseases, liver and pancreas. Obesity. Lipomobilization syndrome. Fatty liver, atherosclerosis. Ketogenesis and its disorders. Indicators of lipid peroxidation and antioxidant defense system of the body.

Biochemical methods of diagnosing disorders of lipid metabolism and control of its recovery.

Content module 2. Special veterinary clinical biochemistry.

Lectures 5. Clinical fermentologia. Primary and secondary fermentopathy.

Fermentopathy and its variations, and fermentodiagnostic fermentoterapiya. Signal enzymes and their role in the diagnosis of diseases of various organs and systems. Mechanisms hyperenzymemia.

Determination of activity and isozyme spectrum enzymes (aspartate aminotransferase, alanine aminotransferase, lactate dehydrogenase, alaninaminopeptydazy, gamma glutamyl, alkaline and acid phosphatases, hlutamitdehidrohenazy, creatine, alpha-amylase, protease, lipase, etc.). The clinical interpretation of the results.

Lectures 6. Enzymodiagnosics in the pathology of the internal organs of animals.

Fermentodiagnostic and fermentotherapy. Indicator enzymes and their role in the diagnosis of diseases of various organs and systems. Determination of isozyme spectrum and enzymes (aspartate aminotransferase, alanine aminotransferase, lactate dehydrogenase, alaninaminopeptydazy gamma hlutamittranspeptydazy, alkaline and acid phosphatase, hlutamitdehidrohenazy, creatine, alpha-amylase, protease, lipase, etc.). The clinical interpretation of the results.

Lectures 7. Biochemistry and pathobiochemistry of blood system in animals in the pathology of internal organs.

Exchange disorder of hemoglobin. Hemohlobinozy. Biochemical changes in the blood anemia.

System and mechanisms of blood clotting. Pathobiochemistry of coagulation. Anticoagulation blood system. Disorders of hemostasis: hypocoagulation, hypercoagulable and dyskoahulyatsiya.

Metabolism in the myocardium during myocardial dystrophy, myocarditis, pericarditis, coronary heart disease and heart attacks. Biochemical methods of diagnosing myocardial diseases.

Changes in acid-base balance during pneumonia. Changes of oxidoreductase activity, digestive enzymes, metabolic and fibrinolytic system in case of pneumonia. Methods of biochemical control during respiratory diseases: definition of the content of sialic acids, acute phase proteins, carrying bronchopulmonary test etc.).

Lectures 8. Laboratory diagnosis in the pathology of the urinary system.

Features metabolism in the kidney in case of pathology. Formation and urine pathology. Indicators of glomerular filtration rate and their diagnostic value. Biochemical methods enzymodiagnosics if renal pathology.

Changes in the chemical composition of urine in the urinary system diseases: glomerulonephritis, pyelonephritis, nephrotic syndrome, nephrosclerosis, renal failure, urolithiasis and urotsystyti. Abnormal urine components. Proteinuria, glucosuria, lipuriya, hematuria, Ketonuria, bilirubinuria and their diagnostic value. Biochemical mechanisms of urolithiasis. Biochemical methods of urine, interpretation of the results in the differential diagnosis and treatment of animal diseases in the case of the urinary system.

Names of content modules and topic	Number of hours						
	Full-time form						
	Weeks	Total	including				
			L	P	Lab	Ind	Self
1	2	3	4	5	6	7	8
Content module 1. General veterinary clinical biochemistry							
Topic 1. Objects and methods in clinical biochemistry.	1	6	1	-	2	-	8
Topic 2. Disorders of protein metabolism in the case of diseases of the internal organs of animals.	2-3	11	2	-	8	-	7
Topic 3. Laboratory diagnosis of disorders of carbohydrate metabolism in the case of diseases of the internal organs of animals.	4-5	9	2	-	6	-	7
Topic 4. Laboratory diagnosis of disorders lipid metabolism in the case of diseases of the internal organs of animals.	6-7	9	2		6		8

Total for content module 1	*	35	7	-	22	-	30
Content module 2. Special clinical biochemistry							
Topic 5. Clinical fermentologia. Enzymodiagnosics in the pathology of the internal organs of animals.	8-9	11	2	-	6	-	8
Topic 6. Clinical chemistry with the pathology of the digestive system, liver and pancreas.	10-11	10	2	-	6	-	8
Topic 7. Biochemistry and pathobiochemistry blood system in animals in the pathology of internal organs.	12-13	10	2	-	6	-	7
Topic 8. Laboratory diagnosis in the pathology of the urinary system	14-15	9	2	-	5	-	7
Total for content modules 2	*	40	8	-	23	-	30
Total hours	15	75	15	-	45		60

4. Laboratory class topics

№	Topic title	Number of hours
1	Safety at work in biochemical laboratories. Preparation of biological material for the clinical and biochemical studies. Laboratory examination of gastric juice.	3
2	Studies of total protein and protein fractions of blood serum, the interpretation of changes.	6
3	Proteinuria, qualitative and quantitative methods for determination of protein in the urine. The remaining (non-protein) nitrogen and its components, the clinical significance of their research.	4
4	Metabolism of carbohydrates and clinical significance of study parameters of carbohydrate metabolism. Glycosuria, clinical and diagnostic value of research available glucose in the urine.	4
5	Metabolism of lipids and clinical diagnostic value of the study of lipid metabolism. Investigation of ketone bodies in urine.	4
6	Studies of water and electrolyte metabolism and clinical diagnostic value of these studies.	4

7	Investigation of serum enzymes and their significance in the diagnosis of diseases of the internal organs.	6
8	Hemoglobinopathies. Clinical significance study of hemoglobin in the blood	4
9	Clinical biochemistry with liver disease. Determination of total bilirubin and its fractions in biological material.	6
10	Thymol test. Biochemical methods immunodeficient state of the animals. Electrophoresis of serum proteins in polyacrylamide gels.	4
Total		45

5. Independent work topics

№	Topic title	Number of hours
1	Rules for taking samples of biological material.	12
2	Peculiarities of protein metabolism in liver, lung, heart and kidney tissues.	12
3	Peculiarities of carbohydrate metabolism in liver, lung, heart and kidney tissues.	12
4	Peculiarities of lipid metabolism in liver, lung, heart and kidney tissues.	12
5	Organ-specific enzymes of organs and tissues for the diagnosis of diseases	12
Total		60

6. Samples of control questions, tests for assessing the level of knowledge acquisition by students

Test questions

- Biochemical methods for the whole organism.
- Subject and methods of discipline "Clinical chemistry"? Its connection with related disciplines. A brief history of the formation of discipline.
- The role and importance of discipline "Clinical chemistry" in forming a comprehensive veterinary.
- Clinical Biochemistry equipment and laboratory equipment.
- The rules of work and safety at work in modern biochemical laboratory. Objects of research in clinical biochemistry.
- Methods of blood, urine, saliva, rumen contents, cerebrospinal fluid, synovial substances, digestive juices and other biological fluids.
- Age, breed specific features of biochemical parameters (blood, urine, cerebrospinal fluid, digestive juices, saliva, etc.) in healthy animals.
- Impact of ecological situation in Ukraine on physiological condition and quality products. Heavy metals as toxicant of animals and humans.

9. Biochemistry disorders of the structure, functions and biochemical processes in the liver, with farm animals. The role of the liver in the metabolism of carbohydrates and main tests of control carbohydrate metabolism in the liver.
10. The role of the liver in lipid metabolism and basic tests monitoring of liver in lipid metabolism.
11. Biosynthetic protein metabolism and liver function. Biochemical tests that establish the state of the liver in protein metabolism.
12. Liver and currency pigments, hormones, vitamins and trace elements. Biochemical tests that monitor the state of the liver in the pigment, hormone, vitamin metabolism and metabolism of bioactive compounds.
13. Disorder of the chemical composition of gastric contents mono- and polihastrychnyh animals. Methods of determination. Normal and abnormal values total, free and bound hydrochloric acid in gastric juice, with different types of farm animals.
14. By what parameters determine the acid-base balance in animals.
14. As classified infringement acid-base status?
15. Clinical significance of determining the acid-base balance of the body sick animals.
16. Correction of metabolic acidosis in the body of newborn calves with acute indigestion.
17. The method of determining acid-base balance in the body of newborn calves?
18. The principle of electrophoresis of serum proteins?
19. Clinical significance of determining aminotransferase activity.
20. Determination of urea in the blood, clinical and diagnostic value?
21. Changes in electrolyte composition of body fluids (Na +, K +, HCO₃⁻, etc.). Acute indigestion in the small intestine.
22. Machinery obtaining blood serum differences and blood plasma.
23. The study of blood proteins. Methods of electrophoresis.
24. What is the role albumin and what functions they are responsible. What are plasma proteins containing metals?
25. With which enzymes can judge the state of the liver?
26. In determining which diseases enzymatic activity of alkaline phosphatase.
27. What are the pigments plasma you can call, clinical and diagnostic value of definition?
28. Factors affecting blood parameters (performance, physiological state, feeding, age, breed, seasonality, etc.)
29. What processes occur in animals with metabolic proteins that occur in this disease?
30. Clinical and biochemical value determination of lipid metabolism. Diseases that occur at the same time.
31. Clinical and biochemical value determination of carbohydrate metabolism, diseases in which it noted violations?
32. What is the rate of sugar in animals and in which the disease is changing?
33. Define and explain the term "renal clearance"?
34. Define and explain the term "renal threshold"?
35. What is the renal threshold for glucose?
36. Define the term "renal azotemia"?
37. Clinical and diagnostic value, that changes the proportion of urine?
38. What are the biochemical changes occurring in acute nephritis?
39. What are the biochemical changes occurring in chronic nephritis?
40. What are the biochemical changes occurring during nephrosis?
41. Define the term glucosuria?
42. Define the term pentosuria?
43. Define the term laktosuria?
44. Define the term fruktosuria?
45. Define the term proteinuria?
46. What are the components of urine you know?

47. What are urinary stones?
48. Define the term cystonuriya?
49. Clinical fermentology. Value section and main directions.
50. Primary fermentopathy.
51. Secondary fermentopathy.
52. Enzymodiagnosics and its value.
53. Acid-base balance of the blood of animals, methods of its determination.
54. State of the acid-base balance in the blood of newborn calves and ways of correction.
55. What are the biochemical studies to hold suspected kidney disease?
56. What devices you know to determine the acid-base balance.
57. How to conduct analysis of the electrophoregram?
58. What is the principle method of zinc sulfate test and its clinical and biochemical values?
59. Principle of thymol test and its clinical and biochemical values?
60. What are the irregularities in the body can cause a change of acid-base status?
61. What methods of correction of the acid-base balance, you know?
62. The principle of the method, clinical and biochemical importance of alkaline reserve of blood plasma.
63. Clinical and biochemical values to determine carotene.

The set of tests

National university of life and environmental sciences of Ukraine

Education degree	Master	
Specialization	211 Veterinary Medicine	
Educational program	Veterinary Medicine	
Cours (year of study)	4	
Semester	7	
Discipline	Veterinary clinical biochemistry	
Approved at the meeting	Department of biochemistry and animal physiology named acad. Maxim Hulyi, Protocol №9 03.05.2022	
Head of department	_____	_____
	surname and initials,	signature
Lecture	_____	_____
	surname and initials,	signature

Question 1. Blood biochemical sample in cattle, horses, sheep, goats and camels is taken out

- 1 ear vessels
- 2 cranial vena cava
- 3 of hearts
- 4 jugular vein

Question 2. Hyperuricemia

- 1 increase of uric acid in the urine
- 2 increase of urea in urine
- 3 increase of urea in the blood
- 4 increased uric acid in the blood

Question 3. Sympathetic hyperglycemia occurs ...

- 1 after the collapse of high fat
- 2 after an increased degradation of proteins
- 3 increased after the collapse of glycogen
- 4 increased after the collapse of amino acids

Question 4. Appearance in serum enzymes whose activity is not found in a healthy body ...

- 1 parafermentamia
- 2 disfermentamia
- 3 dyfektofermentamia
- 4 polifermentamiya

Question 5. Diabetic hyperglycemia develops ...

- 1 insufficient secretion of thyroxine
- 2 inadequate secretion of adrenaline
- 3 insufficient secretion of glucagon
- 4 insufficient insulin secretion

Question 6. Out of liver enzymes in the blood in the destruction of cells called ...

- 1 elumination
- 2 elimination
- 3 illumination
- 4 luminescence

Question 7. What do you understand by the term "proteinuria"?

- 1 increasing the protein content in the blood
- 2 increasing protein fractions in the blood
- 3 reduce protein in the urine
- 4 appearance of protein in the urine

Question 8. Most often, increased urea in blood occurs by ...

- 1 liver damage
- 2 heart disease
- 3 renal lesions
- 4 defeat muscles

Question 9. What substances belong to ketone bodies?

- 1 acetic, butyric, β -oksymaslyana acid
- 2 propionic, β -oksymaslyana acid
- 3 β -oksymaslyana, acetoacetic, butyric acid
- 4 β -oksymaslyana, acetoacetic acid and acetone

Question 10. Which of these components is the most important part of residual nitrogen of blood

....

- 1 ammonia
- 2 urea
- 3 uric acid
- 4 creatinine

Question 11. The presence of starch in the faeces suggests ...

- 1 liver disease
- 2 bowel disease
- 3 kidney disease
- 4 pancreas disease

Question 12. For the purposes formolovu use and thymol test?

- 1 diagnosis of disorders of lipid metabolism

- 2 diagnosis of disorders of carbohydrate metabolism
- 3 diagnosis of metabolic lipids and carbohydrates
- 4 diagnosis of metabolic proteins

Question 13. What transaminase enzymes belong to?

- 1 ALT, GGT, LDH
- 2 LDH, GGT, AST
- 3 ALT, AST, LDH
- 4 ALT, AST, GGT

Question 14. Anacidic gastritis ...

- 1 reduce allocation of hydrochloric acid
- 2 increase allocation of hydrochloric acid
- 3 miss hydrochloric acid and enzymes
- 4 no hydrochloric acid

Question 15. Hyperazotemia is

- 1 increasing the total protein in the blood
- 2 increasing the content of residual nitrogen in the blood
- 3 increasing of free amino acids in the blood
- 4 increasing ammonias in blood

Question 16. The level of glucose in the blood which begins glucosuria

- 1 threshold heart
- 2 hepatic threshold
- 3 renal threshold
- 4 glycemc threshold

Question 17. The formation of lactic acid in animals is

- 1 for aerobic oxidation of glucose
- 2 in the urea cycle
- 3 for the anaerobic oxidation of glucose
- 4 in β -oxidation of fatty acids

18. The issue of total protein in serum of healthy animals (cattle)?

- 1 120-130 g / l
- 2 54-64 g / l
- 3 30-44 g / l
- 4 72-86 g / l

Question 19. Indicator liver enzymes?

- 1 LDH, GGT
- 2 AST, LDH
- 3 ALT, GGT
- 4 SDG, OCT

Question 20. When blood takes in monogastric animals

- 1 in the evening before feeding
- 2 in the morning, 4 hours after feeding
- 3 in the morning immediately after feeding
- 4 in the morning on an empty stomach

Question 21. Gastric Akhil is...

- 1 reduced allocation of hydrochloric acid
- 2 increased allocation of hydrochloric acid
- 3 missing hydrochloric acid and enzymes
- 4 increased allocations of hydrochloric acid and enzymes

Question 22. What characterizes the enzyme in urine glomerular filtration condition?

- 1 LDH
- 2 GGT
- 3 CE
- 4 ALT

Question 23. Hyperlipemia is ...

- 1 increase lipid levels in the urine
- 2 increase of lipoproteins in the blood
- 3 increase lipid levels in the blood
- 4 raising HDL in urine

Question 24. When rumen content is selected

- 1 before feeding
- 2 immediately after feeding
- 3 an hour after feeding
- 4 three hours after feeding

Question 25. In biochemical studies, birds blood takes from

- 1 forearm saphenous vein
- 2 underwing veins
- 3 cranial vena cava
- 4 lateral shin saphenous vein

Question 26. Residual nitrogen retention increases in blood at hyperazotemia through

- 1 ammonia
- 2 urea
- 3 creatinine
- 4 creatine

Question 27. Hipoacidic gastritis is ...

- 1 reduced allocation of hydrochloric acid and enzymes
- 2 missing enzymes
- 3 missing hydrochloric acid and enzymes
- 4 reduced allocation of hydrochloric acid

Question 28. Braking cycle of Citric acid formes ...

- 1 amino acid
- 2 carbohydrates
- 3 lipids
- 4 ketone bodies

Question 29. Which fraction of proteins called "acute phase"

- 1 α -globulins
- 2 albumin
- 3 β - globulins

4 g-globulins

Question 30. What do you mean by the term "alkaline reserve"?

- 1 concentration of anions of carbonic acid [HCO₃⁻] in the blood
- 2 pCO₂ increase in acidosis in the blood.
- 3 pCO₂ reduction in respiratory alkalosis blood
- 4 reduced pH in the blood.

7. Teaching methods

The organization of education in National University of Life and Environmental Sciences of Ukraine means a combination of classroom and extracurricular learning, such as:

- Lectures;
- Seminars;
- Workshops (laboratory work, laboratory practice);
- Independent classroom hours;
- Independent class work of students;
- Advice;
- Course design (coursework);
- Graduation design (thesis);
- All types of practices.

To control the quality of knowledge and skills students are used:

- Control of work;
- Individual interview;
- Colloquiums;
- Tests;
- Examinations;
- Protection projects and dissertations;
- State exams;
- A comprehensive examination in the specialty.

During the study course "Veterinary Clinical Biochemistry" use the following teaching methods:

- Lectures;
- Laboratory classes;
- Independent classroom hours;
- Independent class work of students;

8. Forms of assessment

Monitoring and evaluation of academic performance of students is an important part of the educational process in higher education.

Control (from Fr. Control) in the didactics of higher education should be understood as a pedagogical support, monitoring and verification of successful teaching and learning of students.

Process control exercised by the teacher involves several steps:

- 1) test (detection level obtained by the students' knowledge and skills);

2) assessment (measurement of knowledge, skills, and compare them with certain standards defined curriculum requirements);

3) accounting (fixation results in the form of ratings, scores, rankings magazine student's record book, scoring or examination information).

By controlling teaching and learning activities of students, faculty aims to address the following objectives:

- Identify the quality of learning, the extent to which the obtained skills goals and objectives of the course;

- Identify difficulties in mastering educational information and standard errors for the purpose of correction and elimination;

- Determination of efficiency of organizational forms, methods and means of education;

- Diagnosing the level of students' readiness to accept new material.

Normal control the following functions:

- Training (education), which is to control measures contributed to the deepening, widening, improvement and systematization of knowledge and skills students provide feedback on learning;

- Diagnostic and corrective aimed at determining the level of knowledge, skills, and common errors, gaps and difficulties in learning, causes of failure and ensure corrective action;

- Estimates, which is to clarify the state of knowledge, skills and abilities of individual students and academic group as a whole, and provides accounting and transparency control results, contributing to the objective evaluation and better training;

- Stimulating, providing for the approval of the students achieved success and formation of positive motivation for learning, systematic teaching and learning activities, developing a sense of responsibility for its effectiveness;

- Developing, which consists in the fact that under systematic, developing pedagogically appropriate control memory, attention, thinking, oral and written expression, ability, educational interests, activity and independence of students;

- Educational, aimed at shaping discipline, organization, self-discipline skills, positive attitudes to learning, the need for ongoing formation of self-education and self-improvement;

- Prognostic and methodical, which refers both to the teacher (who is very precise information on the effectiveness of the activity), and students as an optimal teaching, improve teaching methods, can significantly affect the outcome - the quality of vocational training graduates.

The following types of controls: previous, current, topical, final.

Ante control is carried out to identify the level of student preparedness to accept new material. Such verification may be conducted in the form of tests, written tests, oral questioning front on practical exercises, individual or group counseling.

Content Knowledge test is aimed at determining the level of mastering a particular topic or more related subjects (modules). One of the main objectives is to create a content check prerequisite for understanding and synthesis of a

sufficiently large volume of training data. For the thematic control, which can be done at the final seminar or colloquium in the module or content tests, tasks are selected and constructed so as to eliminate the elements of chance and objectively assess the educational progress of students in all sections of the theme.

Final control is to check the level of learning, practical abilities and skills of students over a long period of time learning semester, the entire period of study at the university. The purpose of the final control is to identify the knowledge structure and knowledge of students. The components of the control – terminal control and state certification. Allow the student to the final control if the performance of all types of work, the curriculum for the semester in this discipline.

Credit – special means to implement the final inspection and assessment of academic achievement of students.

Semester credit – a form of total control from a single discipline per semester, which aims to test the assimilation of theoretical and practical material.

Credits are for the paper, approved by the department. Teacher necessarily introduces students to the content exam questions.

To control the quality of knowledge and skills of students in the discipline "Veterinary clinical biochemistry", the following control measures:

- Module tests;
- Individual objectives;
- Individual interview;
- Set-off.

9. Distribution of grades received by students. Evaluation of student knowledge is carried out on a 100-point scale and is converted to national grades according to Table 1 "Regulations and Examinations and Credits at NULES of Ukraine" (order of implementation dated 03.03.2021, protocol №7)

Student rating, points	National grade based on exam results	
	Exams	Credits
90-100	Excellent	Passed
74-89	Good	
60-73	Satisfactory	
0-59	Unsatisfactory	Not passed

In order to determine the rating of a student (listener) in the discipline R_{dis} (up to 100 points), the rating from the exam R_{ex} (up to 30 points) is added to the rating of a student's academic work R_{aw} (up to 70 points): $R_{dis} = R_{aw} + R_{ex}$.

10. Educational and methodological support.

1. Tomchuk V., Tsvilikhovskyi V., Grishchenko. Guidelines for training on discipline. K., NUBiP Ukraine, 2022. 67 p.
2. Томчук В.А., Грищенко В.А., Цвіліховський В.І. Методичні вказівки для самостійної роботи з дисципліни “Ветеринарна клінічна біохімія”. К., ВЦ НУБіП України, 2015. 101 с.

11. Recommended sources of information

Basic

1. Ветеринарна клінічна біохімія: навч. посіб. / Мельничук Д. О. та ін.; 2-ге вид. перероб і доп. Київ: НУБіП України, 2014. 456 с.
2. Ангельські С., Якубовські З., Домінічак М. Клінічна біохімія /; пер. з пол. Сопот, 1998. 451 с.
3. Ветеринарна клінічна біохімія / Левченко В. І., та ін. ; 2-ге видання, перероб. та доп. Біла Церква: Аграрна наука, 2019. 416 с.
4. Горячковский А. М. Клиническая биохимия. Одесса: Астропринт, 1998. 608 с.

Supplemental

1. Tomchuk V.A., Gryshchenko V.A., Tsvilikhovskyi V.I. Veterinary clinical biochemistry: textbook / Part 1. K.: НУБіП України, 2016. 268 p.
2. Tomchuk V.A., Gryshchenko V.A., Tsvilikhovskyi V.I. Veterinary clinical biochemistry: textbook / Part 2. K.: НУБіП України, 2017. 365 p.
3. Клінічна біохімія : навч. посіб. для студ. вищ. навч. зал. / О. П. Тимошенко, та ін.; 2-ге видання. Київ: ВД «Професіонал», 2005. 288 с.
4. Кононський О. І. Біохімія тварин: підруч. для студ. вищ. навч. зал. / 2-ге вид. К.: Вища шк., 2006. 454 с.
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11. Information resources

1. <http://nubip.edu.ua/node/4210>
2. <http://vetmed.nauu.kiev.ua/>

12. Electronic training course of the discipline (on the educational portal of NULES of Ukraine eLearn)

<https://elearn.nubip.edu.ua/course/view.php?id=1345>

13. Lecture notes and their presentations (in electronic form)

<https://elearn.nubip.edu.ua/course/view.php?id=1345>