


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

Department of General, Organic and Physical Chemistry

“ APPROVED ”

Dean of the Faculty Plant protection,
biotechnology and ecology


Yu. KOLOMIETS
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“ REWIED and APPROVED ”

at a meeting of the Department of General,
Organic and Physical Chemistry
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 Andrii HALSTIAN

“ APPROVED ”

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 Valeria BONDAR

**WORK PROGRAM OF ACADEMIC DISCIPLINE
CHEMISTRY (ORGANIC, PHYSICAL AND COLLOID)**

Field of knowledge	<u>E Environmental sciences</u>
Specialty	<u>E2 Ecology</u>
Educational program	<u>Ecology</u>
Faculty of	<u>Plant Protection, Biotechnology and Ecology</u>
Developers:	<u>Halstian Andrii, Head of the department of general, organic and physical chemistry, doctor of chemical sciences, professor</u>

Kyiv - 2026

Academic discipline description **Chemistry (organic, physical and colloid)**

The discipline consists of three main parts: organic, physical, and colloidal chemistry. Each part includes clearly formulated theoretical concepts, explanations of chemical process mechanisms, and examples of their applications in industrial ecology.

The first part is devoted to the fundamentals of structure, reactivity, and functional groups of organic compounds relevant to ecology. Separately, the mechanisms of organic reactions, such as nucleophilic substitution, elimination, oxidation, and reduction, which are key to the synthesis and modification of biologically active compounds, are considered.

The second part covers the basics of thermodynamics, kinetics, and chemical reaction equilibrium. Key concepts such as Gibbs energy, chemical potential, reaction rates, and catalytic processes which play an important role in industrial ecology are examined in detail.

The third part addresses the fundamentals of dispersed systems, surface phenomena, and the stability of colloidal solutions, which are crucial in biotechnological processes such as fermentation, emulsification, and purification of biological products.

Branch of knowledge, specialty, educational program, educational qualification		
Educational qualification	«Bachelor»	
Specialty	E2 «Ecology»	
Educational program	«Ecology»	
Characteristics of training programme		
Type	Ordinary (standard)	
The total number of academic hours	120	
Number of ECTS credits allocated	4	
Number of modules	3	
Forms of control	Exam	
Indicators of academic discipline for full-time and part-time forms of training course		
	Full-time	Part-time
Year of study (course)	1	
Semester	2	
Number of lecture, hours	30	
Number of seminars, practical classes	-	
Laboratory sessions (activities)	30	
Independent study	60	
Individual lessons	-	
Number of weekly in-class academic hours for full-time forms of training	4	

1. Purpose, tasks and competencies of the discipline

Purpose: formation of students' theoretical foundations of chemistry, practical skills in working with different types of organic compounds, study of specific features of their behavior in chemical reactions, gaining experience in a chemical laboratory to solve specific practical problems, ability to work with scientific literature .

List of academic disciplines that precede the study

Chemistry (inorganic and analytical).

Acquisition of competences:

integral competence (IC): The ability to solve complex specialized tasks and solve practical problems in the field of ecology, environmental protection and balanced nature management, which involves the application of basic theories and methods of environmental sciences, which are characterized by the complexity and uncertainty of conditions.

general competences (GC):

GC 8. Ability to conduct research at the appropriate level.

GC 11. Ability to evaluate and ensure the quality of the work performed.

Special (professional) competences (SC):

SC 2. Ability to critically understand basic theories, methods and principles of natural sciences.

Program learning outcomes (PLO):

PLO 3. Understand the main concepts, theoretical and practical problems in the field of natural sciences, which are necessary for analysis and decision-making in the field of ecology, environmental protection and balanced nature management.

PLO 21. Be able to choose optimal methods and tools for research, data collection and processing.

2.The program and structure of the academic discipline

Modules and themes	hours													
	full-time learning							Part-time						
	Week	Total	including					Total	including					
			Lec	Pr	Lab	Ind	Ind		Lec	Pr	Lab	In d	Ind	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Module 1. The most important theoretical principles of organic chemistry. Aliphatic and carbocyclic hydrocarbons. Oxygen-containing organic compounds														
Topic 1. Introduction. The most important theoretical principles of organic chemistry. Arenas.	1,2	16	4		4		8							
Topic 2 Hydroxyl organic substances: alcohols, phenols Carbonyl and carboxyl compounds: aldehydes, ketones	3,4	16	4		4		8							
Topic 3 Carboxylic acids, fats	5,6	16	4		4		8							
Total for module		48	12		12		24							
Module 2 Carbohydrates. Nitrogen-containing organic substances														
Topic 1. Carbohydrates	7,8	16	4		4		8							

Topic 2. Amines. Amino alcohols. Amino acids. Proteins. Heterocyclic compounds. Nucleic acids	9,10	16	4		4		8						
Total for module		32	8		8		16						
Module 3. Fundamentals of physical and colloidal chemistry													
Topic 1. Fundamentals of physical chemistry	11, 12, 13	16	6		6		10						
Topic2. Fundamentals of Coloid Chemistry	14, 15	14	4		4		10						
Total for module		30	10		10		20						
Total		120	30		30		60						

3. Lectures topic

№ з/п	Title theme	Hours
1	Introduction. The most important theoretical principles of organic chemistry. Arenas.	4
2	Hydroxyl organic substances: alcohols, phenols Carbonyl and carboxyl compounds: aldehydes, ketones	4
3	Carboxylic acids, fats	4
4	Carbohydrates	4
5	Amino alcohols. Amino acids. Proteins. Heterocyclic compounds. Nucleic acids	4
6	Fundamentals of physical chemistry	6
7	Fundamentals of Coloid Chemistry	4

4. Title themes laboratory studies

№	Title theme	Hours
Module 1. The most important theoretical principles of organic chemistry. Aliphatic and carbocyclic hydrocarbons.		
1	Basics of safety. Methods of isolation and purification of organic matter. Qualitative elemental analysis.	2
2	Hydrocarbons. Obtaining and studying the properties of methane, ethylene.	2
3	Arenes. Terpenes . Study of properties.	2
4	Study of the properties of alcohols and phenols.	2
5	Aldehydes and ketones. Study of properties Study of the properties of carboxylic acids. Lipids (fats)	2
6	Properties of halogenated hydrocarbons. Test work "Hydrocarbons/ Oxygen-containing organic compounds "	2
Module 2. Nitrogen-containing organic substances. Heterocyclic compounds.		
7	Study of the properties of mono- and disaccharides. Study of the properties of polysaccharides.	2
8	Nitrogen-containing organic substances	2

9	Amines, amides. Study of the properties of amino acids and proteins	2
10	Heterocyclic compounds Test work ""	2
Module 3. Fundamentals of physical and colloidal chemistry		
11	Designation of the heat of the reaction of salt crystallization and the heat of the reaction of neutralization	2
12	Acid-base power differences. pH-metry	2
13	Follow-up adsorption of octic acid on activated carbonum	2
14	cleaning and properties of colloidal systems	2
15	Test work. Fundamentals of physical and colloidal chemistry	2

5. Teaching methods

The following teaching methods are used in the study of the discipline:

- methods of organization and implementation of educational and cognitive activities: verbal (story- explanation, conversation, lecture); visual (illustration, demonstration); - practical (laboratory works, abstracts);

- methods of stimulating and motivating educational and cognitive activities: stimulating interest in learning (creating a situation of interest in teaching material, educational discussions); stimulation of duty and responsibility (explanation of the purpose of the subject, disciplinary and organizational and pedagogical requirements for the study of the subject, encouragement and punishment in education);

- methods of control, correction of the effectiveness of educational and cognitive activities: current and intermediate surveys, tests, individual tasks, interviews.

6. Forms of control

The main forms of knowledge control are control at the lectures at labs and workshops, outside the classrooms, and the consultations, tests and exams.

I. Control of the lectures can be conducted as a selective oral questioning of students or tests using the previously laid material, particularly in sections of the course that are necessary for the understanding of the lecture topics, read, or to establish a degree of mastery of the material lectures (held by the manner of the late first or early second hour lectures). Testing during lectures designed to teach students to systematic elaboration covered material and prepare for the upcoming lectures, establish the degree of assimilation theory to identify the most difficult students to read chapters from the following explanation of them. Control of ther lectures has to subtract time. By spending time to conrol oral examination yields control, programmable for cards.

II. Current control on laboratory studies conducted to elucidate ready students for employment in the following forms:

1. Writing (30 min.). Control work.

2. Colloquium on separate sections of theoretical courses (modules or themes).

III. Credits. Some subjects (theoretical courses, practical training) is applied differential test of performance appraisal on a five point scale. In a lecture course or its individual parts, which are not accompanied by laboratory or practical classes, the teacher may conduct interviews or colloquium, offer oral or written questions.

IV. Examinations. Exam is a final step in the study of the whole or part of the discipline and are designed to test students' knowledge on the theory and identify the skills apply the acquired knowledge in solving practical problems, as well as independent work skills with educational and scientific literature.

Student's rating of knowledge of an academic discipline consists of training work rating – 70 points and final attestation – 30 points. Thus, rating of content modules, that are constituents of an academic discipline, makes 70 points. Rating of content modules as well as attestation rating are also measured by 100-point-scale.

7. Distribution of points received by students

Assessment of student knowledge is on a 100-point scale and is translated into national assessments according to table. 1 "Regulations on examinations and tests in NULES of Ukraine" (order of entry into force of 27.12.2019 № 1371

Percentage score	National grade	
90-100	Excellent	Passed
74-89	Good	
60-73	Satisfactory	
0-59	Unsatisfactory	Non-passed

8. Educational and methodological support

1. Методичні вказівки для самостійної роботи з дисципліни «Органічна хімія» для виконання лабораторних робіт. В.В.Кротенко, Л.О.Ковшун, Р.С.Бойко, Хижан О.І., Бухтіяров В.В. К.: Видавничий центр НАУ, 2021.- 145 с.

2. Хижан О.І., Ковшун Л.О. Фізична і колоїдна хімія: навчальний посібник. К.: НУБіП України, 2022. 436 с.

3. Хижан О.І., Ковшун Л.О. Навчальний посібник. Фізична і колоїдна хімія. К.: НУБіП України, 2019. 444 с.

4. Khyzhan O.I., Boyko R.S., Kovshun L.O., Krotenko V.V. Methodical recommendations for laboratory works in physical and colloid chemistry for students of the bachelor level of qualification. K.: DDP Expo-Druk, 2022, 157 p.

9. Recommended sources of information

1. Kovshun L.O., Boyko R.S., Khyzhan O.I., Krotenko V.V. Notebook for Laboratory Works in ORGANIC, BIOORGANIC, PHYSICAL AND COLLOID CHEMISTRY. Kyiv: NULES of Ukraine, 2019. 240 p.

2. Хижан О.І., Ковшун Л.О. Фізична і колоїдна хімія: навчальний посібник. К.: НУБіП України, 2022. 436 с.

3. Ковшун Л.О., Хижан О.І. Навчальний посібник. Фізична і колоїдна хімія. К.: НУБіП України, 2018. 501 с.

4. Хижан О.І., Ковшун Л.О. Навчальний посібник. Фізична і колоїдна хімія. К.: НУБіП України, 2019. 444 с.
5. Khyzhan O.I., Boyko R.S., Krotenko V.V. , Kovshun L.O. Notebook for laboratory works in phisycal and colloid chemistry. К.: DDP Expo-Druk, 2021, 155 p.
6. Khyzhan O.I., Kovshun L.O. Notebook for laboratory works in phisycal and colloid chemistry. К.: DDP Expo-Druk, 2020, 160 p.
7. Хижан О.І., Ковшун Л.О. Науково-методологічні основи лабораторного контролю безпеки сільськогосподарської продукції. Монографія. К.: НУБіП України, 2022. 448 с.
8. Tereshchenko N.Yu., Kovshun L.O., Khyzhan O.I., Nesterova K.A.. Methodology of laboratory control for the production of safe plant products. Monograph. Kyiv: NULES of Ukraine, 2021. 480 p.