

Ministry of Education and Science of Ukraine
Sumy National Agrarian University
Faculty of Agrotechnologies and Environmental Management
Department of Biotechnology and Chemistry

Syllabus of the educational component

EC 14 CHEMISTRY **(mandatory)**

Implemented within the educational program

G– Engineering, Manufacturing and Construction

in specialty **G13 - Food Technology**

at **the first (bachelor's)** level of higher education

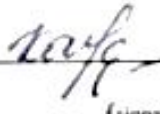
Developed by:  Viktoriia IVCHENKO, PhD, Assistant Professor of
the Department of Biotechnology and Chemistry

Reviewed approved at meeting of Department Biotechnology Chemistry	and the of the of and	Protocol dated 19.05.2026. № 24	
		Manager Department	<u></u> (signature) Vladyslav KOVALENKO

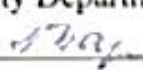
Agreed:

Guarantor of Educational Program  Olena KOSHEL
(signature) (full name)

Dean of the Faculty of FOOD Technology
where the Educational Program is implemented  Nataliia BOLHOVA
(signature) (full name)

Review of the course syllabus provided by:  Olena KOSHEL
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 Nataliia Bolhova
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Methodologist of the Educational Quality Department,
Licensing and accreditation  (N. Baraniv)
(signature) (full name)

Registered in the electronic database: date: 22.05 2026 .

Information about reviewing the work program (syllabus):

Educational the year in which are introduced changes	Number of the appendix to the work program with a description of the changes	Changes considered and approved		
		Date and number of the minutes of the Department meeting	Head of the Department	Educational Program Guarantee Person

1. GENERAL INFORMATION ABOUT THE EDUCATIONAL COMPONENT

1.	Name of the EC	EC 14 CHEMISTRY							
2.	Faculty/Department	Agrotechnology and environmental management/biotechnology and chemistry							
3.	EC status	Mandatory							
4.	Program/Specialty(s) that include OK for	EVP "Food Technologies" EVP " Craft Technologies and Gastronomic Innovations" / "Food Technologies"							
5.	The EC may be offered for	-							
6.	NQF level	Level 6							
7.	Semester and duration of study	1th semester, 1-15 weeks							
8.	Number of credits ECTS	5							
9.	Total hours and their distribution	Contact work (classes)						Independent work	
		Lectures		Practical /seminar		Laboratory			
		Daily	Abroad	Daily	Abroad	Daily	Abroad	Daily	Abroad
		14	4	-	-	46	10	90	136
10.	Language of instruction	Ukrainian, English							
11.	Lecturer/Coordinator of the educational component	Viktoriia Ivchenko							
11.1	Contact information	E-mail: ivchenkovd@gmail.com							
12.	General description of the educational component	The educational component includes sections of inorganic, analytical, physical, colloidal and organic chemistry, which are necessary for a deep understanding of technological processes in food production. The content of the discipline is adapted to the specialty. The subject of this course is chemical laws and concepts that form the foundation of all chemical knowledge, the properties of elements, simple and complex substances and organic compounds as nutrients in human nutrition. When teaching the basic chemical laws, attention is focused on their role in the transformation of food raw materials during technological processing.							
13.	The purpose of education component	to provide a sufficient theoretical and practical level of knowledge of students in inorganic, analytical, physical, colloidal and organic chemistry, which would allow both to correctly understand the chemical essence of modern food technologies and to create fundamentally new progressive technologies in accordance with the chosen direction							
14	Prerequisites for studying EC, connection with other educational components of the EVP	1. The educational component is based on knowledge of chemistry (terminology, basic laws and concepts, properties of ions depending on their location in the periodic table of D.I. Mendeleev), physics (understanding the basic laws of chemical reactions), the basics of higher mathematics (performing calculations), experimental techniques (knowledge of chemical dishes, concentrations). 2. The educational component is the basis for studying the components: "Biochemistry", "Food microbiology", "Theoretical foundations of food production", "Food control methods"							
15	Academic policy virtue	is provided in accordance with the Code of Academic Integrity							

		(http://surl.li/khyd) Adherence to academic integrity for higher education applicants involves: independent completion of educational tasks, tasks of current and final control of learning results; reference to sources of information in the case of using ideas, statements, information; compliance with the norms of copyright legislation; provision of reliable information about the results of one's own educational or scientific activities. Violations of academic integrity when studying EC "Chemistry" are considered: academic plagiarism, academic fraud (copying, deception, passing off someone else's work as one's own), use of electronic devices during the final control of knowledge For violation of academic integrity, education applicants may be held to the following academic responsibility: Academic plagiarism - score 0, re-performance of the task. Academic fraud - cancellation of points received; re-passing the assessment, re-performance of work not completed independently; Using electronic devices during the final knowledge test – suspension from work, score 0, retaking the final test
16	Keywords	Inorganic chemistry, analytical chemistry, physical chemistry, colloidal chemistry, organic chemistry, chemical properties, analysis of substances, physicochemical transformations, components of food raw materials.
17	Link to the course in Moodle system	https://cdn.snau.edu.ua/moodle/course/view.php?id=4644#

2. LEARNING OUTCOMES FOR THE EDUCATIONAL COMPONENT AND THEIR RELATIONSHIP WITH PROGRAM LEARNING OUTCOMES

Learning outcomes for the EC: After completing the educational component, the student is expected to be able to...»	Program learning outcomes, the achievement of which is aimed at the EC (indicate the number according to the numbering given in the profile of the EP Food Technologies)			Assessment of learning outcomes
	PLO 5	PLO 6	PLO 18	
DLO 1. To know the regularities of physico-chemical and biochemical transformations of the main components of food raw materials, which are the basis of technological processes of food production.	+	+		Multiple-choice and matching tests; case-based tasks; examination
DLO 2. Understand the influence of the chemical composition of raw materials and the conditions of reactions on the course of the synthesis and metabolism of food	+	+		Multiple-choice and matching tests; case-based tasks; examination

components				
DLO 3. Know the chemical composition of micro- and macronutrients and their role in human nutrition		+		Multiple-choice and matching tests; oral questioning; examination
DLO 4. Possess basic skills in conducting laboratory experiments, correctly using instruments, laboratory glassware, reagents, materials, observing safety rules, resource and energy conservation and principles of sustainable development	+		+	Laboratory work reports; Multiple-choice and matching tests, examination
DLO 5. Be able to independently acquire modern knowledge, analyzing scientific literature, information resources, and effectively establish communications when performing team tasks			+	Presentation with an oral report

LIST OF COMPETENCIES TO BE DEVELOPED/ACQUIRED THROUGH NON-FORMAL EDUCATION

Chemicals and health

General:

- Ability to work independently
- Ability to learn and master modern knowledge.

Professional:

- Ability to organize and conduct quality and safety control of raw materials, semi-finished products and food products using modern methods.
- Ability to ensure product quality and safety based on relevant standards and within the framework of food safety management systems during their production and sale.
- Ability to conduct research in specialized laboratories to solve applied problems

<https://www.ours-era.org/learn/courses-chemicals-health#modules>

Form of confirmation of learning outcomes:
certificate of successful completion of training with the number of hours indicated. The authenticity of the certificate can be checked by clicking on the link on it.

3. ЗМІСТ ОСВІТНЬОГО КОМПОНЕНТА (ПРОГРАМА НАВЧАЛЬНОЇ ДИСЦИПЛІНИ)

Topic List of questions to be considered within the topic	Distribution within the overall time budget			Recommended reading
	Classroom work		Independent work	
	Lc	Lab		
	Daily/Abroad	Daily/Abroad	Daily/Abroad	
MODULE 1				
Inorganic Chemistry				
Topic 1. Basic Concepts and Laws of Chemistry Basic concepts of atomic and molecular science. The role of chemistry in food technology. Safety precautions when working in a chemical laboratory The law of conservation of mass and energy. The law of equivalents. Avogadro's law. Historical stages of the development of chemistry.		2/2 2	4/8	2, 11,12
Topic 2. Atomic Structure and Chemical Bonding Quantum mechanical principles of the structure of atoms. Nuclear model of the structure of the atom. Quantum numbers and energy levels. Electronic formulas. Modern interpretation of the periodic law of D.I. Mendeleev. Electronic formulas of atoms and the Periodic System. Changing the properties of elements in the world of the Periodic law of D.I. Mendeleev. Modern understanding of the nature of the chemical bond. Main characteristics and types of chemical bond.		2	4/10	2, 8,11,12
Topic 3. Modern Classification of Inorganic Compounds and Chemical Reactions Classification of inorganic compounds according to their composition and chemical properties. Relationship between the most important classes of inorganic compounds. Preparation and properties of oxides, bases, acids, salts. Composition, structure and nomenclature of coordination compounds. Concept of double and mixed salts, their chemical properties. Laboratory Work No. 1 "Main classes of inorganic compounds"		2	4/10	2,4,11,12
Topic 4. Disperse Systems. Solutions The concept of dispersed systems and their classification. Solutions, their role in technological	2/2	2/2	4/8	2,4,10,11,12

processes of storage, processing and preservation of food raw materials. Natural water - a multicomponent solution. Physico-chemical nature of solutions. Solvation and thermal effect of dissolution. The concept of crystal hydrates. Solubility. Methods of expressing the composition of solutions. Laboratory Work No. 2 "Preparation of solutions of a given concentration"		2		
Topic 5. General Concepts of Redox Reactions Modern, general concepts of redox reactions. Oxidation degree of chemical elements, oxidizing agents and reducing agents. Electron balance method. Features of the course of redox reactions depending on the media. Types of redox reactions. Methods of compiling equations of redox reactions. Laboratory Work 3: "Redox reactions"	2/-	2	4/8	2,4,11,12
Topic 6. Chemical Characteristics of Elements and Their Compounds General characteristics of s-,p-,d - elements. Their main physical and chemical properties. Content of s-,p-,d - elements as micro- and macroelements in individual components of food raw materials. Application of compounds of Oxygen, Sulfur, Sodium Chloride, Phosphates, Nitrates and Nitrites in technologies of processing and preservation of food raw materials. Salts of Copper, Zinc, Manganese, Iron, Cobalt, and other biogenic metals in the food industry.		2	4/8	2, 8,11,12
Analytical chemistry				
Topic 7. Qualitative Analysis The concept of analytical reactions and reagents used for their implementation. Main and side reactions. External signs, sensitivity, specificity, selectivity and features of the conditions for performing analytical reactions. Features of identifying unknown compounds, determining the chemical composition of a solution. Fractional and systematic analyses. Analytical classification of ions, group and specific reagents for cations and anions of the main biogenic elements. Features of performing qualitative analysis of cations and anions of the main biogenic elements. Laboratory Work 4. «Qualitative Analysis of cations and anions»		2/2	4/8	1,5,6,7,11,12
Topic 8. Quantitative Analysis Quantitative Analysis as an experimental basis for scientific research in agronomy. Reliability of quantitative analysis results, its systematic and random errors. Units of expression of the quantitative content of	2/-		4/8	1,5,6,7,11

ions or compounds in the objects under study: soil, plant, fertilizer, etc. Requirements for precipitated and weight forms of sediment in gravimetry and features of their provision; typical sequence of operations and methods of sediment processing. Weighing sediments and accuracy of gravimetric methods Classification of titrimetric methods and requirements for their basic reactions and starting substances. Concept of the titration process. Standard and standardized solutions. Working titrated solutions. Features of acid-base titration. Features of redox titration. Precipitation titration. Complexometric titration. Laboratory Work 5 “Standardization of HCl by storm”		2		
MODULE 2				
Physical and colloidal chemistry				
Topic 9. Fundamentals of Electrochemistry. Electrode potentials. Electric double layer. Nernst equation. Hydrogen electrode. Voltage range of metals. Galvanic cell. Electrical conductivity of electrolyte solutions. Corrosion of metals. Main features. Mechanism of corrosion. Hydrogen and oxygen depolarization. Types of corrosion. Methods of protecting food equipment from corrosion.		2	4/8	2,4,10,12
Topic 10. Chemical Thermodynamics. The subject of chemical thermodynamics, its peculiarity and significance for physical and colloidal chemistry. State parameters. State functions. Various forms of energy. General concepts. Internal energy. Work. The first law of thermodynamics. Enthalpy. Energy effect of chemical reactions. Hess's law. Standard enthalpy of reaction. Consequences of Hess's law. Chemical bond energy. Direction of chemical processes. Second law of thermodynamics. Entropy. Gibbs energy. Direction of chemical processes. Conditions for the spontaneous course of chemical reactions.	2/-	2	4/8	3,4,11,12
Topic 11. Chemical Kinetics Basic concepts of chemical kinetics. Chemical reaction rate and factors affecting it. The law of active masses is the basic law of chemical kinetics. Chemical reaction rate constant. Concept of activation energy. Effect of temperature on reaction rate. Van't Hoff's rule. Concept of catalysis and its nature. Peculiarities of reaction kinetics in heterogeneous systems. Chemical equilibrium and ways of its displacement. Irreversible and reversible chemical reactions. Chemical equilibrium. Chemical equilibrium constant. Displacement		2	4/8	3,4,11,12

[illegible]

jellies. Gelation, swelling, classification of gels. Thixotropy. Syneresis. High-molecular electrolytes - proteins. Isoelectric point of protein. Laboratory Work 8: "Establishment of the isoelectric point of proteins"		2		
Organic chemistry				
Topic 15. Basic Principles of Organic Chemistry. Carbohydrates. Theory of the chemical structure of organic compounds O.M. Butlerov. The concept of hydrocarbon chains. Classification of organic compounds. The concept of "functional group", "homologue", "isomer". Homologous series and nomenclature of hydrocarbons. Electronic and spatial structure of alkanes, alkenes, alkynes and arenes. Physico-chemical properties and methods of obtaining and using hydrocarbons in the food industry Laboratory Work 9. Obtaining and studying saturated and unsaturated hydrocarbons		2	4/10	3,8,12
Topic 16. Oxygen-Containing Organic Compounds. Alcohols and phenols. Aldehydes, ketones. Alcohols, their classification and nomenclature. Physical and chemical properties of alcohols. Production and use of alcohols. Phenols, their properties, applications, environmental protection. Aldehydes and ketones, their nomenclature, properties, production and use. Carboxylic acids. Esters. Fats. Carbohydrates. Carbohydrates, their nomenclature, properties, production and use. Esters, fats: Molecular structure, physical and chemical properties. Carbohydrates Structural features. Classification of carbohydrates: monosaccharides, oligo-, polysaccharides. Glucose, sucrose, starch, cellulose; their properties, applications. Laboratory Work 10. Properties of oxygen-containing organic compounds	2/-	2	5/5	3,5,12
Topic 17. Nitrogen-Containing Organic Compounds. Amines, Amino Acids and Proteins General concepts of nitro compounds, amines, amino acids, proteins. Their structure, chemical properties. Mechanism of peptide bond formation. Protein content in food raw materials and products. Main biological functions of proteins and peptides. Classification of proteins. Biological value of proteins as food components.		2	5/5	3,8,12
Total	14/4	46/10	90/136	

4. TEACHING AND LEARNING METHODS

DLO	Teaching methods (work that will be carried out by the teacher <u>during classroom lessons</u> , consultations)	Number of hours Daily/ Abroad	Learning methods (what types of learning activities should <u>the student perform? independently</u>)	Number of hours Daily/ Abroad
DLO 1. To know the regularities of physico-chemical and biochemical transformations of the main components of food raw materials, which are the basis of technological processes of food production.	<i>Explanatory and reproductive methods:</i> lecture, story-explanation, conversation, aimed at distinguishing the value-oriented content of the educational material (in the context of professional tasks) Use of the platform <i>MOODLE, Labster, Kahoot, ZOOM during blended learning.</i>	20/2	work with textbooks, manuals, Internet materials; , illustration, demonstration, performing experiments, exercises, didactic tasks, independent work, etc.	20/25
DLO 2. Understand the influence of the chemical composition of raw materials and the conditions of reactions on the course of the synthesis and metabolism of food components	<i>Partial-search methods:</i> problem-dialogue, modeling, case method, etc. Inductive methods - related to the prediction of observations and experiments based on experience Use of the platform <i>MOODLE, Kahoot, ZOOM during blended learning.</i>	10/2	independent search for educational information, performing laboratory work of partial search content, complex didactic tasks and tasks.	20/25
DLO 3. Know the chemical composition of micro- and macronutrients and their role in human nutrition	<i>Visual methods</i> - demonstration of experiments Practical methods - work with reagents, laboratory glassware and devices in compliance with safety rules. Use of the platform <i>MOODLE, Labster, Kahoot, ZOOM during blended learning.</i>	10/4	reading literature on the topic, watching videos on the Internet and on the Moodle platform Performing and submitting laboratory work	20/25
DLO 4. Possess basic skills in conducting laboratory experiments, correctly using instruments, laboratory glassware, reagents, materials, observing safety rules, resource and energy conservation and principles of sustainable development	<i>Research methods:</i> conducting research, working in the laboratory. • Deductive method - built on the basis of generalizations. • Problem-search methods when performing laboratory work Use of the platform <i>MOODLE, Labster, Kahoot, ZOOM during blended learning</i>	10/2	searching information for writing reports and presenting the results obtained, performing and submitting laboratory work of a research nature	15/25
DLO 5. Be able to independently acquire modern knowledge,	<i>Problems</i> - disputes on the studied material. Lecture-press conference.	10/4	reading literature on the topic, watching videos on the Internet and on the	15/36

analyzing scientific literature, information resources, and effectively establish communications when performing team tasks	Use of the platform <i>MOODLE</i> , <i>ZOOM</i> during blended learning.		Moodle platform	
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5. EVALUATION BY EDUCATIONAL COMPONENT

5.1. Diagnostic assessment (indicated as appropriate)

5.2. Summative assessment

5.2.1. For the assessment of expected learning outcomes, there are

No.	Summative methods evaluation	Points	Date drafting
Module 1 (35 Points)			
	Laboratory work (5LRs, 1 point each)	5 Points / 5%	According to the schedule of the educational process
	Intermediate testing (multiple choice test)	15 Points / 15%	6 weeks
	Performance of individual calculation work on module topics	15 Points / 15%	According to the schedule of the educational process
Module 2 (35 Points)			
	Laboratory work (5LRs, 1 point each)	5 Points / 5%	According to the educational process schedule
	Interim testing (multiple choice test)	10 Points / 10%	15 weeks
	Performing an individual version of the calculation work on the topics of the module	10 Points / 10 %	According to the educational process schedule
	Presentation with an oral report or by choosing to take a non-formal education course	10 Points /10%	10-15 weeks
	Exam (three tasks: 1. multiple choice tests; 2. solving a situational problem; 3. solving a calculation problem)	30 Points / 30%	17-18 weeks

5.2.2 Evaluation criteria

Component	Assessment
Laboratory work reports	Each completed laboratory work is valued at 1 point. The test includes 30/20 questions, each of which is valued at 1/2 point.
Midterm testing	Each completed laboratory work is valued at 1 point. The test includes 30/20

(multiple choice test)	questions, each of which is valued at 1/2 point.			
Performing an individual version of the calculation work	Unsatisfactory	Satisfactory	Good	Excellent
	<3 points	3-5 points	6-8 points	9-10 points
	The requirements for the task are not met.	Most of the requirements are met, but individual components are missing or insufficiently disclosed, there is no analysis of other approaches to the issue	All task requirements are met, the situational task is solved completely, Minutes are compiled	All task requirements are met, creativity, thoughtfulness are demonstrated, and an own solution to the problem is proposed
Presentation with an oral report	<3 балів	3-5	6-8 балів	9-10 балів
	The requirements for the task were not met.	The presentation was prepared, but the report was not clear or logical.	All the requirements of the task were met, the report and presentation met the requirements.	All the requirements of the task were met, creativity and thoughtfulness were demonstrated, and the original solution was proposed.
Exam	The examination paper includes tasks at three levels: Level 1: 10 multiple-choice test questions - each correct answer is evaluated as 1 point (0-10 points); Level 2: Solving a situational task (0-10 points) 10 points - the material is presented in full, the presentation is logical, the conclusions and generalizations are well-reasoned; 8 - 9 points - there are minor shortcomings in the presentation of the material, the presentation is not sufficiently systematized, there are some inaccuracies in the conclusions and generalizations; 5 - 7 points - there are gaps in the presentation of the material, the presentation is not systematized, the conclusions and generalizations are poorly argued, there are errors in them; 2 - 4 points - the main content of the material is not presented, there are no conclusions and generalizations. 0 - 1 point - the question is not presented. Level 3: Calculation problem (0-10 points) The solution must be logical (sequential), the obtained value is accurate to tenths, with formulas and actions indicated. A detailed justification is given for each action. The number of points for correct execution is 10 points. The maximum number of points scored by a student on the exam is 30.			

Formative assessment:

№	Elements of formative assessment	Date
1.	Written survey after studying the topics with feedback from the teacher	15 min at the end of the lesson when completing the topic
2.	Oral feedback from the teacher while working on situational tasks during classes	next lesson after studying a new topic
3.	Oral feedback from the teacher and students after the	10-15 weeks

	presentation with a report	
4.	Express survey with mutual checking by students	before each work in the chemistry laboratory
5.	Final test control with feedback from the teacher	at the end of each studied section
6.	Conducting research on the topic under the supervision of the teacher	10-15 weeks
7.	Solution of calculation problems with group discussion	30-45 min when studying each new topic

Final assessment form – examination. Final course score for the discipline is a maximum of 100 points per semester. It is determined as the sum of points based on the results of the applicant's work during the semester. A student is not allowed to take the final examination for the discipline if he/she has missed and has not completed more than 20% of the classes and has failed module examinations.

5. LEARNING RESOURCES (LITERATURE)

5.1. Main sources

1. Tsvetkova, Lyudmila Borisivna. General Chemistry: Theory and Problems. Part 1: Textbook / Lyudmila Borisivna Tsvetkova. - Lviv: "Novyi Svit -2000", 2023. - 398 p.
2. Tsvetkova, Lyudmila Borisivna. Inorganic Chemistry: Theory and Problems: Textbook / Lyudmila Borisivna Tsvetkova. - 2nd ed., revised and supplemented - Lviv: "Novyi Svit -2000", 2023. - 352 p.
3. Tsvetkova, Lyudmila Borisivna. Physical Chemistry: Theory and Problems: Textbook / Lyudmila Borisivna Tsvetkova. - Lviv: "Novyi Svit -2000", 2022. - 415 p.

5.2. Additional sources

4. Tsvetkova L. B. Colloid chemistry: theory and problems: textbook / L. B. Tsvetkova. - Lviv: "Novyi Svit -2000", 2023. - 286 p.
5. Tsvetkova, Lyudmila Borisovna. Chemistry in tables, diagrams, definitions, questions and answers: textbook / Lyudmila Borisovna Tsvetkova.- Lviv: "Novyi Svit -2000", 2023. - 114 p.
6. Ivchenko V.D., Shvets O.G., Inshina N.M., Ponomareva L.M., Bolshanina S.B., Myronenko V.O. ANALYSIS OF THE INFLUENCE OF PACKAGING MATERIAL ON BEER QUALITY INDICATORS, Bulletin of SNAU, Series "Mechanization and Automation of Production Processes", Issue 1 (59), 2025, pp. 32 – 38
7. Ivchenko V. D., Shvets O. G. Development of critical thinking of students during refractometric study of sucrose content in food products / Modern problems of biology, ecology and chemistry: Collection of materials of the VII International Scientific and Practical Conference (April 25-27, 2024). – Zaporizhzhia: Printing Center "CopyArt", 2024 – pp. 273-276
- Samilyk, M., Ivchenko, V., Nosyk, M., Tischenko, V., Ryzhkova, T., Hnoievyi, L., Petrenko, A., & Hrinchenko, D. (2025). Devising a technology for manufacturing wine from

mulberry using osmotic dehydration. *Eastern-European Journal of Enterprise Technologies*, 3(11 (135)), 82–88. <https://doi.org/10.15587/1729-4061.2025.328926>

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5.2. Methodological support

1. Chemistry: a textbook (for 1st year students of non-chemical specialties) / O.G. Shvets, V.D. Ivchenko, L.M. Ponomareva. – Sumy, 2025. – 330 p.
2. Ivchenko V.D. Chemistry: lecture notes for 1st year students of specialty G-13 “Food Technologies” of full-time and part-time study for the degree of bachelor. – Sumy, 2025. – 60 p.
3. Ivchenko V.D. Chemistry. Methodological instructions for conducting laboratory work for 1st year students of specialty G-13 “Food Technologies” of full-time and part-time study for the degree of bachelor. – Sumy, 2025. – 63 p.
4. Ivchenko V.D. Chemistry. Methodological guidelines for independent work for 1st year students of specialty G-13 “Food Technologies” of full-time and part-time study for the degree of “bachelor”. – Sumy, 2025. – 78 p.

Software

Software (to support distance learning (Moodle), online surveys (Kahoot, LearningApp, ChemSketch, Labster), etc.