СИЛАБУС НАВЧАЛЬНОЇ ДИСЦИПЛІНИ
«Biochemistry»

Ступінь вищої освіти «Бакалавр»
Спеціальність 101 «Екологія»
Освітня програма «Екологія»
Рік навчання 2, семестр 4
Форма здобуття вищої освіти денна
Кількість кредитів ЄКТС 4
Мова викладання українська

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ОПИС НАВЧАЛЬНОЇ ДИСЦИПЛІНИ

(до 1000 друкованих знаків)

The discipline "Biochemistry" studies the chemical composition of living organisms and the environment, as well as the relationships between them. Complex knowledge of the structure, physico-chemical and biological properties of chemical and organic compounds, which are a component of all living things, as well as the environment, their rational complementarity, are essential and necessary for the further application of the knowledge and skills of ecologists in their professional activities. In living nature, diversity and balance are combined due to the presence of numerous regulatory mechanisms and communications, which are based on complex biochemical transformations. It is the study of biochemical foundations that lays the foundation for understanding the deep processes of interaction between different living organisms, both among themselves and in ecosystems.

The task of the course is to acquaint students with the structure and properties of chemical elements and their compounds, the main classes of bioorganic compounds with their classification, functions and properties, biochemical mechanisms of transformation of exo- and endogenous compounds and adaptation of living organisms. Theoretical aspects of the discipline are reinforced by students in laboratory classes in order to acquire and consolidate practical skills when working in a chemical, biochemical, biotechnological laboratory, which will allow them to plan scientific research and analyze the obtained experimental data in the future.

Competencies of the academic discipline:

Integral competences (IC):

The ability to solve complex specialized problems 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):

GC1. Knowledge and understanding of the subject area and professional activity.

Special (professional) competences (SC):

SC2. Ability to critically understand basic theories, methods and principles of natural sciences.

SC5. Ability to assess the impact of technogenesis processes on the state of the environment and identify environmental risks associated with production activities

Program learning results of the academic discipline (PLR):

PLR7. Solve problems in the field of environmental protection using generally accepted and/or standard approaches and international and domestic experience.

PLR21. Be able to choose optimal methods and tools for research, data collection and processing.

СТРУКТУРА НАВЧАЛЬНОЇ ДИСЦИПЛІНИ

Тема	**Години** (лекції/лабораторні роботи)	**Результати навчання**	**Завдання**	**Оцінювання**
4 семестр				
Module 1. Molecular and chemical composition of living organisms and environment				
Theme 1. Introduction to biochemistry	2/2	*Know:* Subject and tasks, main sections (static, dynamic, biochemistry of organs and tissues) and types of biochemistry (human and animal, plants, microorganisms, viruses, medical, molecular, etc.). The history of the development of biochemistry. *Understand:* The contribution of outstanding scientists to the development of biochemistry as a science. *Familiarize yourself with:* safety and rules of work in a biochemical laboratory.	Perform and submit laboratory work	Completion and submission of laboratory and independent works, as well as Module control in the form of tests (on eLearn) and oral/written survey - according to the evaluation log in eLearn
Theme 2. Modern biochemical methods	2/2	*Know:* Qualitative and quantitative assessment of the chemical composition of substances.	Perform and submit laboratory work	Completion and submission of laboratory and independent works, as well as Module control in the form of tests (on eLearn)

		Understand: principles of pH-metry, conductometry, UV-Vis, IR, electron, NMR, confocal and fluorescence spectroscopy methods *Apply:* Methods of isolation and purification, separation of proteins - salting out, electrophoresis, chromatography, (UV-Vis, IR, electron, fluorescence spectroscopy, gel electrophoresis, HPLC, Western blot analysis, etc. spectroscopy, etc.		and oral/written survey - according to the evaluation log in eLearn
Theme 3. Molecular and chemical composition of living organisms.	2/2	*Know:* Functional groups of biomolecules. Hydrocarbons and hydro compounds (acyclic, aromatic, homo-, heterocycles), carboxylic acids. Bioorganic compounds of nitrogen (amines NO_2-NH_2 and amides COOH-NH_2). Heterofunctional compounds (COOH +NH_2 + OH groups. *Understand:* the structure of heterocyclic compounds, low molecular weight physiologically active substances (alkaloids).	Perform and submit laboratory work	Completion and submission of laboratory and independent works, as well as Module control in the form of tests (on eLearn) and oral/written survey - according to the evaluation log in eLearn

		Apply: Ashing methods. Microchemical analysis of ash. Qualitative determination of mineral substances.		
Theme 4. The role of water in the life of living organisms. Buffer systems.	2/2	*Know:* Macro- and microelements. *Understand:* the structure of biogenic elements. *Use:* methods for qualitative reactions to non-protein nitrogenous compounds. The main patterns of water absorption by the cell are osmosis. *Apply:* Methods of estimating pH in buffer solutions, water, soil, biological fluids.	Perform and submit laboratory work	Completion and submission of laboratory and independent works, as well as Module control in the form of tests (on eLearn) and oral/written survey - according to the evaluation log in eLearn
Theme 5. Molecular and supramolecular organization of the cell.	2/2	*Know:* Characteristic features of a plant cell. Understand: Differences between eukaryotic and prokaryotic cells. Extracellular matrix. *Apply:* Qualitative reactions to non-protein nitrogenous compounds.	Perform and submit laboratory work	Completion and submission of laboratory and independent works, as well as Module control in the form of tests (on eLearn) and oral/written survey - according to the evaluation log in eLearn
Theme 6. Protien and amino acids.	2/2	*Know: Structure,* biological functions, classification and properties. Chemical composition of proteins. Characteristics of chromo-, nucleo-, glyco- and	Perform and submit laboratory work	Completion and submission of laboratory and independent works, as well as Module control in the form of tests (on eLearn) and oral/written survey - according to the evaluation log in eLearn

		lipoproteins. Classification of amino acids: replaceable and essential amino acids, polarity of radicals, acyclic and cyclic amino acids. *Distinguish:* Plant proteins. Representatives Sources of vegetable proteins. *Understand:* The role of amino acids in protecting crops from stress. *Apply:* Qualitative reactions to proteins and amino acids. Methods of protein isolation from plant material.		
Theme 7. Carbohydrates.	2/2	*Know:* General properties and classification of carbohydrates, structure and role in living nature. Characteristics of mono-, oligo-, polysaccharides and their main representatives. Stereochemistry of monosaccharides (D-, L- and a-, ß-forms). *Distinguish between:* Derivatives of carbohydrates: sugar acids (aldaric, aldonic, uronic), aminosaccharides, glycosides. Cell wall polysaccharides.	Perform and submit laboratory work	Completion and submission of laboratory and independent works, as well as Module control in the form of tests (on eLearn) and oral/written survey - according to the evaluation log in eLearn

		Apply: Qualitative reactions to monosaccharides.		
Theme 8. Nucleic acids.	2/2	*Know:* Chemical composition of nucleic acids. Purine and pyrimidine bases, nucleosides and nucleotides. *Understand:* Physico-chemical properties of nucleic acids. *Distinguish:* Derivatives of nucleotides and their importance in biosynthetic processes. *Apply:* methods of isolation of nucleoproteins from yeast.	Perform and submit laboratory work	Completion and submission of laboratory and independent works, as well as Module control in the form of tests (on eLearn) and oral/written survey - according to the evaluation log in eLearn
Theme 9. Lipids.	2/2	*Know:* Structure, properties, functions and structural components of lipids. Classification of lipids: fatty acids - structure, properties. Higher fatty alcohols and aldehydes, classification, structure and properties. *Understand:* Neutral lipids, neutral glycolipids, phospholipids - glycerides, classification, structure and properties. Sphingolipids, structure, properties, classification. *Apply:* Methods of determining the	Perform and submit laboratory work	Completion and submission of laboratory and independent works, as well as Module control in the form of tests (on eLearn) and oral/written survey - according to the evaluation log in eLearn

		chemical parameters of fats.		
Навчальна робота				**70**
Модульний тест				**30**
Module 2. Biotransformation of substances and biochemical levels of interaction between living organisms.				
Theme 1. Basic concepts of substance and energy metabolism in nature. Enzymatic reactions.	2/2	*Know:* Major differences between the reactions of synthesis and degradation compounds. Catabolism and anabolism of compounds. *Understand:* Structure and properties of enzymes. Classification and nomenclature of enzymes. *Apply:* Qualitative reactions to non-protein nitrogenous compounds Study of the action of enzymes (amylase and catalase). Properties of enzymes (thermal stability, effect of activators and inhibitors).	Perform and submit laboratory work	Completion and submission of laboratory and independent works, as well as Module control in the form of tests (on eLearn) and oral/written survey - according to the evaluation log in eLearn
Theme 2. Phytohormones.	2/2	*Know:* Classification of phytohormones. Molecular mechanisms of action of phytohormones. *Understand:* The main representatives (auxins, cytokinins, gibberellins, abscisic acid and ethylene), their structure,	Perform and submit laboratory work	Completion and submission of laboratory and independent works, as well as Module control in the form of tests (on eLearn) and oral/written survey - according to the evaluation log in eLearn

		properties and biological effects. *Apply:* Selecting of folic acid (vitamin Bc) from yeast		
Theme 3. Secondary plant metabolites.	2/2	*Know*: properties, structure and classification of secondary metabolites. *Understand*: synthesis, role and use of secondary metabolites. *Apply*: Qualitative reactions to mercury, lead, cadmium, dioxins	Perform and submit laboratory work	Completion and submission of laboratory and independent works, as well as Module control in the form of tests (on eLearn) and oral/written survey - according to the evaluation log in eLearn
Theme 4. Biological activity of xenobiotics	2/2	*Know:* the classification of xenobiotics *Understand:* metabolic pathways of conversion and utilization of xenobiotics. Biochemical mechanisms of toxic action of xenobiotics. Interaction of xenobiotics with biological membranes. *Distinguish*: Systems of biotransformation of xenobiotics. *Apply*: Methods of assessing the content of hazardous chemicals.	Perform and submit laboratory work	Completion and submission of laboratory and independent works, as well as Module control in the form of tests (on eLearn) and oral/written survey - according to the evaluation log in eLearn
Theme 5. Allelopathy and its role in the ecology of agrosystems	2/2	*Know:* Biochemical aspects of stability, adaptation and resistance in living organisms. *Distinguish*: Formation of taste	Perform and submit laboratory work	Completion and submission of laboratory and independent works, as well as Module control in the form of tests (on eLearn) and oral/written survey - according

		and aroma by plants used by domestic and wild animals. *Apply*: methods of determining ammonium ions in groundwater		to the evaluation log in eLearn
Theme 6. Ecological and biochemical interaction of plants and animals	2/2	*Know:* Formation of biochemical reactions of living organisms to the action of pathogens. *Understand*: The effect of mushroom and animal poisons on a living organism *Distinguish*: biochemical changes in living organisms are caused by the action of biotic and abiotic environmental factors. *Apply*: Determination of pH in water and soil	Perform and submit laboratory work	Completion and submission of laboratory and independent works, as well as Module control in the form of tests (on eLearn) and oral/written survey - according to the evaluation log in eLearn
Всього за 4 семестр				**70**
Екзамен				**30**
Всього за курс				**100**

ПОЛІТИКА ОЦІНЮВАННЯ

Політика щодо дедлайнів та перескладання:	Роботи, які здаються із порушенням термінів без поважних причин, оцінюються на нижчу оцінку. Перескладання модулів відбувається із дозволу лектора за наявності поважних причин (наприклад, лікарняний).
Політика щодо академічної доброчесності:	Списування під час контрольних робіт та екзаменів заборонені (в т.ч. із використанням мобільних девайсів). Самостійні роботи, реферати повинні мати коректні текстові посилання на використану літературу та/або електронні джерела.
Політика щодо відвідування:	Відвідування занять є обов'язковим. За об'єктивних причин (наприклад, хвороба, міжнародне стажування) навчання може відбуватись індивідуально (в он-лайн формі за погодженням із деканом факультету).

ШКАЛА ОЦІНЮВАННЯ ЗНАНЬ СТУДЕНТІВ

Рейтинг здобувача вищої освіти, бали	Оцінка національна за результати складання екзаменів заліків	
	екзамен	**залік**
90-100	відмінно	зараховано
74-89	добре	
60-73	задовільно	
0-59	незадовільно	не зараховано

Рекомендовані джерела інформації

Основна література

1. Біологічна і біоорганічна хімія. Підручник у 2 томах/ Л.І. Остапченко, В.К. Рибальченко /– К.: Видавничо-поліграфічний центр «Київський університет», 2015. – 918 с.
2. Біохімія. Підручник / Л..І. Остапченко, Т.Р. Андрійчук, Ю.Д. Бабенюк та ін. / За ред. Л.І. Остапченко – К.: Видавничо-поліграфічний центр «Київський університет», 2012. – 796 с.
3. Біохімія. Підручник / Кучеренко М.Є., Бабенюк Ю.Д., Васильєв О.М., Виноградова Р.П., Войціцький В.М., Курський М.Д., Рибальченко В.К., Цудзевич Б.О. – К.: ВПЦ «Київський університет», 2012. – 480 с.
4. Молекулярна біологія. Підручник / Сиволоб А.В. – К: ВПЦ «Київський університет», 2018. – 384 с.
5. D.L. Nelson, M.M Cox. Lehninger Principles of Biochemistry. Publisher: W.H. Freeman (15th Edition), 2022, ISBN-10: 0-7167-7108-X. ISBN-13: 978-0-7167-7108-1. 1100 p.
6. Кучеренко М.Є., Бабенюк Ю.Д., Войціцький В.М. Сучасні методи біохімічних досліджень. К.: Фітосоціоцентр, 2021. – 424 с.
7. Прилуцька С.В., Гринюк І.І., Ткаченко Т.А. Біохімія. Навчальний посібник. - Київ: Редакційно-видавничий відділ НУБіП України. - 2022. - 192 с.

Допоміжна література

1. Тарасенко Л.М., Непорада К.С., Григоренко В.К. Функціональна біохімія. – Вінниця, Нова книга, 2017. – 378с.
2. Губський Ю.І. Біологічна хімія. – Київ-Вінниця: Нова книга, 2017. – 656с.
3. Thomas D. Pollard, William C. Earnshaw, Ph. D. Cell biology. – Elseviar Sciense (USA), 2022. – 804 p.
4. Прилуцька С.В., Демчук Т.Л., Бойко О.А., Коломієць Ю.В. Навчально-методичні рекомендації з «Біохімії». Видавничий центр НУБіП України. 44 с. 2012. Київ.
5. Григорюк І.П., Бойко О.А., Прилуцька С.В. Фізіологія рослин з основами біохімії. Практикум. Видавництво ТОВ «Аграр Медіа Груп». Київ. 2014. С. 148.