



SYLLABUS

«Chemistry with the Foundations of Biogeochemistry»

Degree of Higher Education – Bachelor

Specialty **101 Ecology**

Educational program - no

Year of training – the forth; Semester: 7

Learning form – full-time

Amount of the ECTS credits - 4

Language of instruction - English

Supervisor
Supervisor's contact
information (e-mail)
eLearn Course URL

Voitenko Larysa Vladyslavivna, Candidate of Chem Sci, Docent
voitenko@nubip.edu.ua

<https://elearn.nubip.edu.ua/course/view.php?id=1105>

DESCRIPTION OF COURSE

Discipline studies chemical, physical, geological and biological processes that are regulating the composition of the environment, biogeochemical cycles in their interaction with living matter through the biological systems of the Earth in time and space. The course includes the laws of the chemical composition formation of the ecosphere; principles of biogeochemical zoning, biogeochemical provinces and endemic diseases in them; theories of the origin of life, ways and types of biogenic and anthropogenic migration of chemical elements; methods for predicting chemical transformations of pollutants; mechanisms of isotope fractionation with living matter; the role of living matter in the geochemical processes of hypergenesis and crust weathering; biogeochemical patterns based on methods of chemical indication of the environmental state; transformation of xenobiotic.

Competencies of the educational programme:

Integral competency (IC): The ability to solve complex specialized problems and solve practical problems in the field of ecology, environmental protection, and sustainable environmental management, which involves the application of basic theories and methods of science about environments that are characterized by complexity and uncertainty of conditions.

General competences (GC):

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

GC8. Ability to conduct research at the appropriate level

GC10. The ability to evaluate and ensure the quality of performed works.

Professional (special) competences (PC):

PC2. Ability to critically understand basic theories, methods and principles of natural sciences.

PC 3. Ability to understand basic theoretical concepts regulations, concepts and principles of natural and of social and economic sciences.

PC7. Ability to monitor and evaluate current condition of environment based on analytical monitoring data.

Program learning outcomes (PLO) of the educational programme:

PLO 3. Understand the basic 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.

PLO14. Be able to create texts, make presentations and messages for professional audiences and the general public with observance of professional integrity and impossibility plagiarism.

PLO18. Combine the skills of independent and teamwork to achieve results with an emphasis on professional integrity and responsibility for decision-making.

PLO19. Increase the professional level by continuing education and self-education.

PLO21. To be able to choose optimal methods and tools for research, collection and data processing.

STRUCTURE OF COURSE

Chapter	Hours (lectures/labs)	Results of learning	Tasks	Grading, scores
The fall semester, the 4th year of study				
Module the 1st. Biogeochemical characteristics of the ecosphere composition				
Chapter 1. Introduction. The object of research and the goal of the discipline. Life origin on the Earth: hypotheses and experimental.	4/6	Know the subject and objectives of the course; areas of environmental issues related to biogeochemistry; modern ideas about the biochemical aspects of the life origin on the Earth (Oparin-Holden theory, RNA theory; progress in creating "artificial" life forms; safety in the chemical laboratory; Be able to work and analyze scientific and educational literature on the subject; Gain practical skills and be able to apply methods and equipment of rapid analysis on the example of determining the content of active chlorine. pH in drinking water; statistical processing of experimental results.	Lab works processing and its defending; online testing on Elern platform	7
Chapter 2. The ecosphere, the chemical elements and biogeochemical laws	4/4	Know different approaches to the formulation of the biosphere concept in terms of its chemical structure and laws of function; Understand the role of living matter as the main driving force of chemical transformation of the biosphere; the reasons for the existence of different types of classification of bioactive elements; biogeochemical functions of living matter. Apply quantitative laws (eg, Redfield atomic ratio, Le Chatelier principle) for environmental forecasts; Gain practical skills to perform analyzes of natural water pollutants (total iron content, nitrates)	Lab works processing and its defending	7
Chapter 3. Biogeochemical zoning and endemic diseases	8/6	Know the basic concepts of biogeochemical zoning and biogeochemical chains according to Kowalski; types and causes of typical endemic diseases, especially in Ukraine; Understand the consequences of the anomalous distribution of chemical elements in the hydrosphere and lithosphere on	Lab works processing and its defending; Module control test	20

		the functioning of living matter; methods of prevention and treatment of endemic diseases; Gain practical skills of analytical determination of the content of fluorides, calcium, and magnesium in natural waters, the abnormal distribution of which is the cause of endemic diseases.		
Total the 1st module	16/16			34
Module the 2^d: Biogeochemical cycles of the main bioactive chemical elements				
Chapter 1. General notions about Biogeochemical cycles. Features of sediment and gaseous biogeochemical cycles. Biogeochemical barriers.	12/10	Know classification, physical, chemical, and biological processes founded of biogeochemical cycling; the energy sources for the realization of the biogeochemical cycling; the experimental proofs of chemical elements cycling in ecosphere; how to apply chemical processes for the organization of biogeochemical barriers dor the prevention of migration of pollutants (acid-basic, clay; RedOx barriers etc.). Understand the experimental proofs of alive matter role in cycling of chemical elements; degree of anthropogenic pressure into biogeochemical cycles; why different scientists give the various quantitative assessment of pools, fluxes, exchange and reserve funds; Gain practical skills of analytical determination of caffeine content in beverages and foods (as psychoactive heterocyclic compound of Nitrogen); determination of active oxygen content and phosphates (as anthropogenic pollutants of natural waters) in laundry detergents and bleaching agents.	Lab works processing and its defending; online testing on Elern platform	16
Chapter 2. Chemistry of preservatives as xenobiotics	2/4	Know the theoretical foundations of application and chemical mechanism of natural and artificial preservatives in food, cosmetic, pharmaceutical, wood-processing and other branches; their classification; risks of xenobiotic preservatives application; Understand the risks for human health of preservatives using; but why modern foods, cosmetic	Lab works processing and its defending; Module control test	20

		goods, medicine drugs etc., are impossible to safe without preservatives; Apply the knowledge of preservative safety and risks in everyday life; Gain practical skills of analytical determination of preservative E220 content (Sulfur dioxide) in foods and grape-containing drinks.		
Total the 2d module	14/14			36
Total of a semester				70
Exam				30
Total for course				100

ASSESSMENT POLICY

<i>Policy regarding deadlines and results:</i>	Assignments submitted after the deadline without valid reasons will be graded lower. Resitting of modules will be allowed with the permission from the lecturer and in the presence of valid reasons (e.g. medical reasons).
<i>Academic honesty policy:</i>	Cheating during tests and exams is strictly prohibited (including the use of mobile devices). Coursework and research papers must contain correct citations for all sources used.
<i>Attendance policy:</i>	Class attendance is mandatory. In case of objective reasons (such as illness or international internships), individual learning may be allowed (in online format by the approval of the dean of the faculty).

SCALE OF ASSESSMENT OF STUDENT KNOWLEDGE

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

RECOMMENDED SOURCES OF INFORMATION

1. Voitenko L. Chemistry with the foundations of biogeochemistry (2019). Kyiv: Naukova stolytsa, 2019. (400 p.) (In Ukrainian).
2. Schlesinger, William & Bernhardt, Emily. (2013). Biogeochemistry: An Analysis of Global Change, Third Edition. Biogeochemistry: An Analysis of Global Change, Third Edition. 672 pp. Academic Press, San Diego,
3. Lab Manual / Voitenko, L.V. (2020). Lab workbook of Biogeochemistry for Bachelor students of Ecology, NUBIP Publ., Kyiv. (98 pp.)
1. Аналітична хімія природного середовища: Підручник/Б.Й. Набиванець, В.В. Сухан, Л.В. Калабіна. – К.: Либідь, 1996. – 304 с.
2. Аналітична хімія поверхневих вод //Б.Й.Набиванець, В.І.Осадчий, Н.М.Осадча та ін. – Київ: Наук. Думка, 2007. – 457 с.
3. Мікроелементози сільськогосподарських тварин. – К.: Урожай, 1974. – 151 с.

4. World Water Day: A Billion People Worldwide Lack Safe Drinking Water - [Электронный ресурс]. – Режим доступа: <http://environment.about.com/od/environmentalevents/a/waterdayqa.htm>
5. Ayers R.S. Water quality for agriculture/ R.S. Ayers, D.W. Westcot // FAO Irrigation and Drainage paper. – Roma, 1994. – 147 pp. [Электронный ресурс] / Режим доступа: <http://www.fao.org/DOCREP/003/T0234E/T0234E00.HTM>
6. Water supply for rural areas and small communities/E.G.Wagner, J.N.Lanoix. – World Health Organization, Palais des Nations, Geneva. – 1959. – 337 pp. – [Электронный ресурс] /Режим доступа: whqlibdoc.who.int/publications/1948-60/9241400420.pdf.
7. Abraham, Ralph. (2009). A Review of “Geochemistry and the Biosphere: Essays by Vladimir I. Vernadsky”. World Futures. 65. 436-441. 10.1080/02604020802631709. https://www.researchgate.net/publication/249036756_A_Review_of_Geochemistry_and_the_Biosphere_Essays_by_Vladimir_I_Vernadsky
8. Samuel S. Butcher et al. (Eds.), 1992, Global Biogeochemical Cycles. Academic, ISBN-8. Global Biogeochemical Cycles <http://www.agu.org/journals/gb/Biogeochemistry>
8. Global Biogeochemical Cycles <http://www.springer.com/west/home/geosciences?SGWID=4-10006-70-35757517-0>. A journal published by Springer.
9. Biogeochemistry articles from across Nature Portfolio. - <https://www.nature.com/subjects/biogeochemistry>