Національний технічний університет України
«КИЇВСЬКИЙ ПОЛІТЕХНІЧНИЙ ІНСТИТУТ
імені ІГОРЯ СІКОРСЬКОГО»

Ecology and Technology of Plant Polymers

Environmental Protection Strategy

Work program of the academic discipline (Syllabus)

Course details	
Level of higher education	***First (bachelor's)***
Field of knowledge	*For all fields*
Specialty	*For all specialties*
Educational program	*For all educational programs*
Discipline status	*Elective*
Form of study	*Full-time (day)/Full-time (evening)/Part-time/Distance learning/Blended learning*
Year of study, semester	*2nd year, fall/spring semester*
Scope of the discipline	*2 (60)*
Semester control/ assessment measures	*Credit / Module Control Work*
Class schedule	*16 hours of lectures, 14 hours of practical work*
Language of instruction	*Ukrainian*
Information about course director/teachers	Lecturer:*https://eco-paper.kpi.ua/pro-kafedru/vykladachi/vizytky.html* Practical / Seminar: *https://eco-paper.kpi.ua/pro-kafedru/vykladachi/vizytky.html*
Course location	*https://do.ipo.kpi.ua/course/view.php?id=497*

Curriculum

1. Description of the academic discipline, its purpose, subject matter, and learning outcomes

The development and implementation of an innovative model of economic development in Ukraine is linked to the development of science, modern knowledge-intensive high-tech industries (information technology, radio electronics, etc.), progressive resource-saving technologies and technical means in industry, transport, and everyday life, effective waste-free technologies, technological solutions, and equipment for cleaning industrial wastewater and emissions. Therefore, it is extremely important in today's world to have a well-rounded education, including environmental training, which will enable future specialists to use their knowledge to actively participate in domestic and international projects related to environmental protection and the development of green entrepreneurship, understand and optimally solve environmental problems in their regions, and be able to develop effective communication strategies to convey ideas, problems, solutions, and their own experience in the field of ecology.

The subject of the academic discipline *"Environmental Protection Strategy" is the process of defining the basic strategies and concepts of society's interaction with the environment, the main preventive strategies for environmental protection, and the main directions of activity to ensure the rational use of natural resources. The scope of this area of ecology includes determining the priority tasks of state policy in the environmental sphere.*

The aim of the credit module *"Environmental Protection Strategy" is to develop students' competencies in:*

- *understand the priority tasks of state policy in the environmental sphere;*
- *propose strategies for managing the environmental safety of Ukraine's regions;*

- *provide a comprehensive assessment of threats and risks to the environmental safety of the country's regions;*
- *choose the most effective and reasonable methods of environmental safety management that lead to the minimization of environmental risks;*
- *consider environmental consequences when making management decisions.*

In accordance with the requirements of the academic discipline, after completing the credit module, students must demonstrate **the** *following* **program learning outcomes**: **knowledge:**

- *properties of the biosphere and principles of its development;*
- *general characteristics of modern technologies and their impact on the environment;*
- *contradictions arising between natural ecological systems and production;*
- *the causes of complex global environmental problems in Ukraine and the world as a whole;*
- *optimal ways to solve specific global and regional environmental problems;*
- *the main provisions of modern concepts of the development of humanity and the biosphere (the concept of the noosphere, the concept of biotic regulation of the environment, the concept of coevolution of nature and society, etc.);*
- *the regulatory and legal framework of Ukraine on environmental policy issues;*
- *principles of forming an environmental monitoring system;*
- *the main provisions for reducing environmental risks;*
- *the main tasks and principles of environmental assessment, environmental management, and auditing.*

skills:

- *navigate the main problems of applied ecology in order to choose the optimal ways to solve them;*
- *justify decisions to reduce environmental risks;*
- *develop an algorithm for conducting environmental impact assessments of facilities that affect the environment;*
- *select methods for expert assessment of anthropogenic pressures on ecosystems.*

Program competencies:
PC02 – Ability to apply knowledge in practical situations SC09 – Skills for safe activity
PC10 – Commitment to environmental protection
PC07 – Readiness to monitor compliance and ensure environmental safety

Program learning outcomes:
PLO 17 – Understanding and compliance with domestic and international regulatory documents on the development, implementation, and technical operation of information and telecommunications networks, telecommunications, and radio engineering systems.

2. Prerequisites and post-requisites of the discipline (place in the structural-logical scheme of training under the relevant educational program)

The study of the discipline "Environmental Protection Strategy" is based on the principles of integration of various knowledge acquired by students in the study of disciplines in the natural sciences, humanities, and engineering and technology. The discipline "Environmental Protection Strategy" is a fundamental basis that should ensure that students master the basics of ecology as a theoretical foundation for environmental protection and the further implementation of the concept of sustainable development.

Prerequisites: "History of Science and Technology." Postrequisites: "Introduction to Philosophy."

3. Contents of the academic discipline

Section 1. Priority tasks of state policy in the environmental sphere

Topic 1. The concept of the environment and its protection

Topic 2. Main properties of the biosphere, principles of its development, and contradictions with objects of the technosphere

Section 2. Comprehensive assessment of environmental safety at the regional, national, and global levels

Topic 3. General characteristics of modern technologies and their impact on the environment

Topic 4. Sources, scale, and consequences of atmospheric pollution

Topic 5. The impact of human activity on the ecological state of the hydrosphere

Topic 6. Waste disposal and recycling

Chapter 3. Environmental Management

Topic 7. Decision-making methods in environmental protection Topic 8. Environmental monitoring

Topic 9. Environmental management and auditing

Topic 10. Environmental law

Topic 11. Environmental assessment

4. Teaching materials and resources

Basic literature

1. *Environmental Protection Strategy: Textbook for Engineering Students of Higher Education Institutions / Igor Sikorsky Kyiv Polytechnic Institute; comp.: T.A. Overchenko, O.I. Ivanenko, V.V. Vember.– Kyiv: Igor Sikorsky Kyiv Polytechnic Institute, 2019. – 132 p.*
2. *Bilyavsky, G.O., Butchenko, L.I., Navrotsky, V.M. Fundamentals of Ecology. – Kyiv: Libra, 2002. – 352 p.*
3. *Vernadsky V.I. Biosphere and Noosphere. – Moscow: Myśl, 1989. – 237 p.*
4. *Dzhygyrey V.S. Ecology and Environmental Protection. – Kyiv: Znannya, 2000. – 203 p.*

Additional literature

1. *Tinsley, I. Behavior of Chemical Pollutants in the Environment / Translated from English. – Moscow: Mir, 1982. – 281 p.*
2. *Babaev N.S. et al. Nuclear Energy, Man, and the Environment. Moscow: Energoatomizdat, 1984.*
3. *Bolbas M.M. Fundamentals of Industrial Ecology. – Moscow: Higher School, 1993.*
4. *Brettschneider B., Kurfürst I. Protection of the Air Basin from Pollution. – Leningrad: Khimiya, 1989.*
5. *Bukrinsky V.V., Kovaleva N.G. Economic Problems of Natural Resource Use. – K, 1995.*
6. *Narytnik T.N., Ilchenko M.E., Kalinin V.I. Microwave Telecommunications Technologies and Biological Safety // Science and Culture. – 2010.– No. 35. – pp. 17-39.*
7. *Globalization and Development Security / O.G. Bilorus, D.G. Lukyanenko. – Kyiv: KNEU, 2001. – 733 p.*

Educational content

5. Methodology for mastering the academic discipline (educational component)

Lectures

Lectures are aimed at:

- *providing up-to-date and comprehensive knowledge of the discipline "Environmental Protection Strategy," the scope of which is determined by the target setting for each specific topic;*
- *determining the current level of development of science and technology in the field of environmental protection and forecasting their development in the coming years;*

- *developing students' professional and business qualities and fostering independent creative thinking;*
- *using methodological features of material processing for better understanding and perception (highlighting main ideas and provisions, emphasizing conclusions, repeating them in different formulations);*
- *using visual aids to facilitate the perception of material: combining lectures with demonstrations of audiovisual materials, diagrams, tables, and models;*
- *explaining all new terms and concepts;*
- *developing the necessary motivation and interest in continuing education through independent work.*

No. No	*Lecture topic and list of key questions (list of teaching aids and tasks for independent study)*
1	***The concept of the environment and its protection*** *Subject, methods, tasks, and structure of modern ecology. Tasks facing engineering personnel in the preservation of the natural environment. Theoretical aspects of environmental safety. Environmental factors and their assessment as hazards of natural and man-made origin: physical, chemical, and biological components.* *Assignment for independent study: The importance of ecology for human civilization.*
2	***Basic properties of the biosphere, principles of its development, and contradictions with objects of the technosphere*** *Principles of the development of the biosphere as a dynamic system. Features of the components of the biosphere (technosphere and sociosphere). The place and responsibility of humans in the biosphere. The noosphere – the newest state of the biosphere. The main provisions of modern concepts of the development of humanity and the biosphere (the concept of the noosphere, the concept of biotic regulation of the environment, the concept of coevolution of nature and society, etc.).* *Assignment for independent study: Ecosystem laws. The biosphere as the largest ecosystem on Earth.*
3	***General characteristics of modern technologies and their impact on the environment*** *Contradictions arising between natural ecological systems and production. Causes of the complex global environmental problems in Ukraine and the world as a whole.* *'s assignment at SRC: Features of the impact of industrial production on the environment environment and ways to protect it.*
4	***General characteristics of modern technologies and their impact on the environment*** *Optimal ways to solve specific global and regional environmental problems.* *Tasks on SRC: Sources and types of pollution of the lithosphere. Ways to reduce anthropogenic impact on the environment.*
5	***Sources, scale, and consequences of atmospheric pollution*** *Functions of the Earth's atmosphere. The ozone layer in the Earth's atmosphere and its role for life on the planet. Global atmospheric problems. Natural and anthropogenic sources and types of atmospheric pollution. Classification of atmospheric air pollution. Characteristics of pollution and its impact on biocenoses and human health.* *Assignment for independent study: Radioecology and the ecological impact of electromagnetic radiation. Electromagnetic safety. Development and evolution of information transmission systems.*

No. No	Lecture topic and list of key questions (list of teaching aids and tasks for independent study)
6	**The impact of human activity on the ecological state of the hydrosphere** *Water resources. Main sources of water supply. Use of water in industry, municipal services, and agriculture. Water supply systems. Rational water use. Sources and types of pollution of surface and groundwater on continents and in the world's oceans. Classification of hydrosphere pollution. The impact of hydrosphere pollution on the degradation of water bodies and human health.* *Assignment for independent study: Problems of providing humanity with drinking water and ways to solve them.*
7	**Waste disposal and recycling** *Waste generation in industrial, municipal, and agricultural production. Classification of waste, methods of its disposal and neutralization. Conditions for waste accumulation and burial. Principles of creating low-waste technological processes.* *Assignment for independent study: Protection of the earth's interior. Mineral resources. Secondary resources. Household waste.*
8	**Decision-making methods in the field of environmental protection** *Rational use of natural resources. Concepts and principles of management in the field of environmental protection. Decision-making system in the field of environmental protection. Regulatory and legal framework of Ukraine on environmental policy. Basic provisions for reducing environmental risks.* *Assignment for independent study: Alternative energy sources, their advantages over traditional sources, and their disadvantages.*
9	**Management in the field of environmental protection** *Environmental monitoring. Purpose, objectives, concept, principles of organization. Types of monitoring. Main tasks and scheme of monitoring the air basin and the ozone layer. Monitoring the quality of surface waters. Monitoring the state of land resources. Principles of forming an environmental monitoring system. The concept of environmental law. The system of environmental law. The subject and methods of environmental law.* *Assignments for independent study: Sectoral, sub-sectoral, and inter-sectoral principles of environmental law.* *International and national legislative and legal frameworks. Fundamental rights and obligations of citizens.*

Practical classes

The teaching of the academic discipline "Environmental Protection Strategy" includes practical classes, which account for 50% of the classroom workload. The practical classes cover a wide range of topics. They allow students to better understand the lecture material, determine the impact of individual groups of pollutants on the environment, and assess the degree of environmental risks.

The main objectives of the practical classes are:

- ✓ *to help students systematize, consolidate, and deepen their theoretical knowledge in the field of ecology and environmental protection;*
- ✓ *teach them techniques for solving practical problems;*
- ✓ *teach students to work with scientific and reference literature, documentation, and diagrams;*
- ✓ *develop independent learning skills, help students master methods, techniques, and approaches to self-education and self-development.*

No. No	Name of the lesson topic and list of main questions (list of teaching aids and tasks for independent study)
1	**The main provisions of modern concepts of human and biosphere development (the concept of the noosphere, the concept of biotic regulation of the environment, the concept of coevolution of nature and society, etc.)**

No. No	Name of the lesson topic and list of main questions (list of teaching aids and tasks for independent study)
	Basic definitions, concepts, and laws of ecology. Ecological systems. Ecology and nature conservation. History and stages of development of ecology. The role of ecology in the modern development of humanity. The natural environment and its components. *Independent study tasks: The connection between ecology and other sciences. The history of the formation and development of* *ecological knowledge in Ukraine.*
2	**Sources, scale, and consequences of pollution of the planet's main ecological spheres** *Global ecological problems of the biosphere of the Earth. Impact of industrial and agricultural production on the biosphere. Pollution of the atmosphere, surface waters, the world's oceans, and the lithosphere, and related environmental problems. Environmental problems on a planetary scale. The state of the environment in Ukraine.* *Assignment for independent study: Environmental problems of the largest cities in Ukraine.*
3	**Technosphere. Technogenic impact on the environment** *The cycle of basic elements in nature. Anthropogenic cycle of substances. Methods of industrial waste disposal and problems existing in this field. Sanitary protection zones.* *'s assignment at SRC: Ecological consequences functioning various industrial industries.*
4	**Theories of ecological development in terms of ecological security** *Development and safety as the two most important functions of the social system. Criteria for eco-progress. Eco-regression. The impact of the quality of the natural environment on human health. Hygienic criteria for environmental quality. The concepts of MPC, MPC, MPC.* *Assignment for independent study: Classification of theories of ecological development.*
5	**State program for waste management in Ukraine** *Natural resources, their use and protection. Natural resources of Ukraine. Generation of production waste. Basic principles of state policy in the field of waste management. Utilization and recycling of solid waste. Generation and disposal of waste from various sectors of the national economy and industrial production. Methods of waste disposal. Landfills. Utilization. Waste management strategy.* *Assignments for independent study: Secondary resources. Household waste. Introduction of low-waste technologies.*
6	**Theoretical and methodological foundations of systematic environmental management** *Decision-making methods in the field of environmental protection. Environmental strategies in the environmental safety management system. Eco-innovative strategies and eco-efficiency. Technological environmental strategy. Bifurcation strategy.* *Assignments for independent study: International environmental strategy. Passive and active environmental strategies.*

7	***Mechanisms for the effective functioning of the environmental quality management system*** *Environmental law. Environmental legislation of Ukraine. Ways to exercise citizens' environmental rights. Environmental assessment.* *Assignment for independent study: The place of environmental law in the system of legal relations. Environmental rights* *guaranteed by the Constitution. International environmental organizations.*
No *No*	*Name of the lesson topic and list of main questions* *(list of teaching aids and tasks for independent study)*
8	***Economic mechanisms for environmental quality management*** *Economics of natural resource use. Methods of economic regulation in the field of environmental protection. Payments for resources, their types, standards, and criteria for calculation. Factors influencing the economic efficiency of implementing* *environmental protection measures. Environmental management and auditing.*

	Assignment for independent study: Social, environmental, and economic outcomes of environmental protection measures. Use of a systematic approach for optimizing processes of natural resource use.
9	*Writing a modular test*

6. Independent work by students

Independent work by students takes up 40% of the course time and also includes preparation for writing a modular test and preparation for the exam. The main task of independent work is to master scientific knowledge in the field of environmental protection that is not included in the list of lecture topics through personal research, the formation of active interest, and a creative approach to academic work.

No. No	*Title of the topic for independent study*
1	*The importance of ecology for human civilization. The connection between ecology and other sciences. The history of the formation and development of ecological knowledge in Ukraine. Ecosystem laws. The biosphere as the largest ecosystem on Earth. Ecological problems of the largest cities in Ukraine. Ecological consequences of the functioning various industrial productions.*
2	*Classification of theories of ecological development. Features of the impact of industrial production on the environment and ways to protect it. Problems of providing humanity with drinking water and ways to solve them. Radioecology and the ecological impact of electromagnetic radiation. Electromagnetic safety. Development and evolution of information transmission systems. Sources and types of lithosphere pollution. Protection of the earth's interior. Mineral resources. Secondary resources. Household waste. Ways to reduce anthropogenic impact on the environment. Introduction of low-waste technologies.*
3	*Sectoral, sub-sectoral, and inter-sectoral principles of environmental law. International and national legislative and legal frameworks. Fundamental rights and obligations of citizens. International environmental strategy. Passive and active environmental strategies. Alternative energy sources, their advantages over traditional sources, and disadvantages. The place of environmental law in the system of legal relations. Environmental rights guaranteed by the Constitution. International environmental organizations. Social, environmental, and economic results of environmental protection measures. Use of a systematic approach to optimize natural resource use processes.*
4	*Preparation for writing a test paper*
5	*Preparation for the exam*

Policy and control

7. Academic discipline policy (educational component)

Rules for attending classes and behavior in class

Class attendance is a mandatory component of assessment. Students are required to actively participate in the learning process, not to be late for classes or miss them without a valid reason, not to interfere with the teacher's conduct of the class, and not to be distracted by activities unrelated to the learning process.

Rules for awarding incentive and penalty points

- *Incentive points may be awarded by the teacher exclusively for creative work in the discipline, but their amount cannot exceed 10% of the rating scale.*

- *Penalty points are not provided for within the framework of the academic discipline.*

Deadline and resit policy

In case of academic debt or any force majeure circumstances, students should contact the instructor via available (provided by the instructor) communication channels to resolve issues and agree on a course of action for
make up for the missed work. If a student is absent on the day of the module control work (MCW)
a student who has provided a medical certificate may write the MCT outside of class hours. Retaking the MCT is not permitted.

Academic integrity policy

Plagiarism and other forms of dishonest work are unacceptable. Plagiarism includes the absence of references when using printed and electronic materials, quotations, and the opinions of other authors. Cheating during tests is prohibited. Hints and cheating during tests and classes, taking exams for another student, and copying materials protected by copyright without the author's permission are not permitted.

The policy and principles of academic integrity are defined in Section 3 of the Code of Honor of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute." For more information, visit: https://kpi.ua/code.

Academic Conduct and Ethics Policy

Students should be tolerant, respect the opinions of others, express their objections in a polite manner, and constructively support feedback in class.

The standards of ethical behavior for students and employees are defined in Section 2 of the Code of Honor of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute." For more information, visit: https://kpi.ua/code.

8. Types of control and the rating system for assessing learning outcomes

Distribution of teaching time by type of class and assignment in accordance with the working curriculum:

Semester	Teaching time		Distribution of teaching hours				Control measures		
	Credits	academic hours	Lectures	Practical	Lab work	SRC	MCW	Calc.work	Semester assessment
3/4	2	60	16	14	–	30	1	–	Credit

The student's grade for the course consists of points awarded for:

1) presentations on topics assigned for practical (seminar) classes or for independent work (each student is expected to give two presentations during seminar classes);

2) active participation in practical (seminar) classes (provided that 10 students are interviewed in one class with a maximum group size of 25 people):

$$\frac{8 \text{ credits} \times 10 \text{ points}}{25} \approx 3 \text{ grades;}$$

3) Completion of a modular test, which can be divided into two 45-minute or three 30-minute tests. The semester assessment is a test.

Rating (weighted) point system and assessment criteria

1. *Work in practical classes*

1.1. Presentation of a substantiated report:

Weighted score – 20. The maximum number of points for all practical classes is 20 points × 2 = 40 points.

Report assessment criteria:

Quality of the report and its defense	Points
Fully disclosed topic report; student thoroughly explains all aspects of the relevant topic, draws the necessary conclusions and generalizations, and clearly answers the questions asked	*20*
The report does not provide sufficient facts and examples; no proper analysis has been conducted; conclusions are not clearly formulated; answers to questions are vague or contain some inaccuracies	*15...19*
The topic of the report is not sufficiently covered; there are no conclusions; there are no answers to some questions	*12...14*
The report does not correspond to the stated topic; all questions remain unanswered. The report is not accepted.	*0*

Participation in practical classes:

Weighting score – 10. The maximum number of points for all practical classes is 10 points × 3 = 30 points.

Criteria for assessing students' knowledge:

Completeness and characteristics of the answer	Points
Active participation in the discussion of all issues, correctness and accuracy of answers and completion of all assigned tasks	*10*
Minor errors were made in completing tasks or discussing the material	*8...9*
The answer is vague; gross errors were made; specific wording of laws and terms is missing	*6...7*
Answer not counted, no activity or preparation for practical training	*0*

2. *Modular test:*

The modular test is conducted in the form of a test.

In total, students must answer 60 questions related to various sections and topics of the academic discipline.

The weighting for each correct answer is 0.5 points. Each answer is evaluated separately, after which the points are added up.

The maximum number of points for writing a modular test is 0.5 points × 60 = 30 points.

Calculation of the rating scale (R)

The discipline rating scale (RD) is 100 points and is formed as the sum of all rating points received by the student based on the results of current control measures:

$$R = 20 \times 2 + 10 \times 3 + 10 \times 3 = 100 \quad .$$

Based on the results of academic work for the first 7 weeks, the "ideal student" should score 20 points. At the first assessment (8th week), the student receives a "pass" if their current rating is at least 10 points.

Based on the results of 13 weeks of study, the "ideal student" should score 40 points. At the second assessment (14th week), the student receives a "pass" if their current rating is at least 20 points.

The necessary conditions for admission to the exam are the acceptance of reports, completion of the test, and a starting rating of at least 40% of R, i.e., 40 points.

Students who have earned a rating of less than 0.6 R during the semester must complete a final test. In this case, all points earned by them during the semester are canceled. The test contains questions related to various sections of the program. The list of test questions is provided in Section 9.

In order for a student to receive a final grade, the sum of all rating points ***R*** *earned during the semester is converted according to the table:*

Number of points	Grade
95	Excellent
85	Very good
75	good
65...74	satisfactory
60	sufficient
RD < 60	unsatisfactory
Admission requirements not met	not admitted

9. Additional information on the discipline (educational component)

Approximate list of questions for semester assessment

1. *List the main groups of global environmental problems facing humanity*
2. *Explain the importance of fundamental and applied ecology for the sustainable development of human civilization.*
3. *Describe the hygienic criteria for environmental quality. The concepts of MPC, MPC, MPC.*
4. *Describe the main ways to solve today's environmental problems.*
5. *Describe the principles of creating low-waste technological processes. What is preventing their rapid and successful implementation in production?*
6. *Describe the main ways of waste in industrial, municipal and agricultural production.*
7. *Explain the principles underlying the development of the biosphere as a dynamic system.*
8. *Describe the role of the biosphere in the emergence and development of life on Earth.*
9. *Describe the main stages of the evolution of the biosphere. List the evidence for the evolutionary development of the Earth's biosphere.*
10. *List the principles of environmental management.*
11. *List the mechanisms for the effective functioning of the environmental quality management system.*
12. *Provide the fundamental ideas and principles on which the regulation of environmental legal relations is based. The regulatory and legal framework of Ukraine on environmental policy issues.*
13. *Describe ways to implement the environmental rights of Ukrainian citizens.*
14. *Characterize the main provisions for reducing environmental risks in the field of environmental protection.*
15. *Describe the mechanism and principles of the targeted use of natural objects, which is ensured by the state.*

16. Describe the environmental protection legislation of Ukraine. Analyze the rights and obligations of natural resource users.

17. Conduct a comparative analysis of the terms "ecosystem" and "biogeocenosis." Identify the similarities and differences between these concepts. In which cases should the term "ecosystem" and in which cases should "biogeocenosis" be used?

18. List the existing types of ecological pyramids. Analyze the differences between the pyramid of numbers and the pyramid of production. Can each of these pyramids have a different (including "inverted") appearance? What is the practical significance of knowing the laws of ecosystem productivity?

19. What does biotic potential reflect? What role does high reproductive potential play in regulating population homeostasis?

20. List the main components that must exist in an ecosystem to maintain the cycle of substances in it. Define the ecological role of producers, consumers, and decomposers.

21. Conduct a comparative analysis of the content of the main biogenic elements in the atmosphere, hydrosphere, lithosphere, and biosphere. What conclusions can be drawn from the results of the analysis?

22. Analyze the characteristics of the cycles of the main biogenic elements in the biosphere and identify their common features and differences.

23. Identify which stages and phases of biological cycles are limiting and can be significantly disrupted by anthropogenic factors.

24. Describe the resource cycle as an anthropogenic cycle of substances. What problems arise in its functioning?

25. Analyze the possibilities of overcoming the negative consequences of the scientific and technological revolution by introducing the concept of sustainable development into all spheres of modern life.

26. Describe the structure, gas composition, and physicochemical properties of the atmosphere. Justify the importance of these properties for the preservation of the Earth's biosphere.

27. Describe the main pollutants of the atmosphere and the environmental problems associated with them.

28. Analyze and compare various methods of protecting the atmosphere from anthropogenic pollution. What methods of cleaning and protecting the atmosphere from gas emissions do you know?

29. Describe the role of the ozone layer for life on Earth. What could the destruction of the ozone layer lead to, and what can humanity do to preserve it?

30. Assess the causes and possible consequences of global warming. What options does humanity have at this stage to solve this problem?

31. Describe the prerequisites for acid rain in different landscapes.

32. Describe the main causes and consequences of global atmospheric problems. What does air pollution control involve at the present stage?

33. Analyze the ways in which the hydrosphere is polluted and classify them. What are the global problems of the hydrosphere?

34. Conduct a comparative analysis of the methods of drinking water purification known to you. What water treatment problems exist today?

35. Analyze the water treatment process for various sectors of the national economy. Describe the state of Ukraine's water basins and determine the current status of solving the problem of providing humanity with drinking water.

36. Describe the processes that occur in water bodies during their self-purification. What can pollution of water resources with biogenic elements lead to?

37. Analyze the characteristics of water use in industry, municipal services, and agriculture. What types of water supply systems are you familiar with? What does the term "rational water supply"?

38. Analyze and explain the causes and consequences of surface and groundwater salinization. Suggest ways to reduce the salinization of fresh and groundwater.

39. Describe the structure and chemical composition of the lithosphere. What are the most pressing global problems of the lithosphere today?

40. Assess the problem of soil conservation in agriculture. Describe modern methods of agriculture. What consequences can man-made soil pollution lead to?

41. Describe the positive and negative aspects of large-scale land reclamation and irrigation.

42. Describe the current state of research into the Earth's interior and its protection. What is the ecological and economic significance of Ukraine's mineral resources?

43. Provide a classification of the Earth's natural resources and analyze which types of extraction and use are most promising for maintaining the sustainable development of the Earth's biosphere.

44. Identify the main features of the stratification of the atmosphere, hydrosphere, and lithosphere. Assess the ecological significance of the structure of the Earth's geospheres.

45. Identify the general engineering principles and approaches that can be proposed for rational nature management and the development of environmentally safe technologies.

46. Justify the forms and mechanisms of degradation of the Earth's biosphere. How does the development of industrial and agricultural production affect these processes?

47. Describe the role of V.I. Vernadsky in the creation of the theory of the biosphere and noosphere. Define the noosphere and analyze its current state of development.

48. Are there any prospects for preserving animal and plant diversity in rapidly changing conditions? What are the consequences of anthropogenic pollution of the environment for the animal world? Justify the importance of the Red Book for the preservation of biodiversity.

49. Describe the main ways of regulating population numbers in the biosphere. What type of relationship maintains population homeostasis?

50. Determine the importance of biogenic elements for maintaining the homeostasis of the biosphere. Describe the mechanisms of the emergence of biogeochemical provinces and biogeochemical endemics.

51. List the main demographic problems and processes that dominate the world. Suggest ways to solve these problems.

52. Analyze the demographic situation in Ukraine. Suggest ways and methods to solve demographic problems.

53. Describe methods for processing solid waste from coke production.

54. Analyze and briefly describe the main problems of energy supply and energy consumption in the modern world. Can alternative energy sources solve existing problems? Justify your answer.

55. Describe methods for reducing the level of radioactive contamination of the environment and for the disposal of radioactive waste. Give examples of methods for the disposal of liquid radioactive waste.

56. Describe the main ways of pollution and approaches to preserving the homeostasis of the Earth's main geospheres.

57. Evaluate environmental monitoring. List its types and functions. Draw a diagram of how environmental monitoring is carried out.

58. Describe the purpose, objectives, and stages of environmental assessment.

Work program for the academic discipline (syllabus):
Compiled by Associate Professor, Candidate of Biological Sciences, Senior Researcher Valeria Vember
Approved by the Department ETRP (Minutes No. 17 dated 23.05.2025).
Approved by the Methodological Council of Igor Sikorsky KPI (Minutes No. 8 dated 29.05.2025).