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

Ecology and Technology of Plant Polymers

PERSPECTIVE RESEARCH DIRECTIONS IN ENVIRONMENTAL PROTECTION.
PART 1. ANALYSIS OF ACTUAL PROBLEMS OF ENVIRONMENTAL PROTECTION

Work program of the discipline (Syllabus)

Details of the discipline

Level of higher education	***Second (Master's)***
Field of knowledge	*10 Natural sciences*
Speciality	*101 Ecology*
Educational program	*Environmental safety*
Discipline status	*Normative*
Form of study	*full-time (full-time)/remote/mixed*
Year of preparation, semester	*1st year, autumn semester*
Scope of discipline	*9/(270)*
Semester control / control measures	*Exam*
Timetable	*8 hours per week (1 hour of lectures and 7 hours of laboratory classes)*
Language of instruction	*Ukrainian*
Information about Course Leader / Instructors	Lector: *https://eco-paper.kpi.ua/pro-kafedru/vykladachi/nosachova-yuliya-viktorivna.html*
Course Placement	*http0s://do.ipo.kpi.ua/course/view.php?id=2151*

The program of the discipline

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

1.1. The purpose of the discipline.

The purpose of the discipline is to form the following competencies in students:

- *Ability to learn and master modern knowledge;*
- *Ability to generate new ideas (creativity);*
- *Ability to search, process and analyze information from various sources;*
- *Ability to develop and improve methods and technologies;*
- *Awareness of the latest achievements necessary for research and/or innovation activities in the field of ecology, environmental protection and sustainable use of natural resources;*
- *Ability to use the principles, methods and organizational procedures of research and/or innovation activities;*
- *Ability to organize work related to environmental assessment, environmental protection and optimization of nature management, in conditions of incomplete information and contradictory requirements*
- *Ability to assess the level of negative impact of natural and anthropogenic factors of environmental hazard on the environment and humans.*

1.2. The main tasks of the discipline.

According to the requirements of the educational-professional and educational-scientific program, students must demonstrate the results of their studies after mastering the discipline:

- *Know and understand the fundamental and applied aspects of the environmental sciences*
- *Be able to use conceptual ecological patterns in professional activities*
- *Know the basic concepts of natural science, sustainable development and methodology of scientific knowledge at the level of the latest achievements*
- *Demonstrate the ability to organize collective activities and implement complex environmental projects, taking into account available resources and time constraints*
- *Demonstrate awareness of the latest principles and methods of environmental protection*
- *Be able to use modern information resources on ecology, nature management and environmental protection*
- *Be able to assess landscape and biological diversity and analyze the consequences of anthropogenic impact on natural environments*
- *Be able to assess the potential impact of man-made objects and economic activities on the environment*
- *Apply new approaches to develop a decision-making strategy in complex unpredictable environments*
- *Assess environmental risks in the face of insufficient information and conflicting requirements*
- *Choose the optimal strategy for managing and/or using natural resources depending on environmental conditions*
- *Critically comprehend theories, principles, methods and concepts from various subject areas to solve practical problems and problems of ecology*
- *Be able to use modern methods of processing and interpretation of information when conducting innovative activities*
- *Be able to independently plan the implementation of an innovative task and formulate conclusions based on its results*
- *Know modern approaches to the organization of environmentally friendly production, reorganization and reconstruction of existing industries from the standpoint of resource saving, taking into account the life cycle of the product*
- *To analyze the results of environmental control of enterprises' activities, to assess the engineering and technical level of means of environmental protection from the harmful effects of production.*

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

2. *Academic discipline "Promising areas of scientific research in environmental protection. Part 1. Analysis of Current Problems of Environmental Protection" provides disciplines, "Promising areas of scientific*

research in environmental protection. Part 2. Theoretical and Experimental Solution of Scientific Problems", master's thesis.

3. CONTENT OF THE TRAINING MATERIAL

Chapter 1. *General information about the concept of science.*
General information about the concept of science. The main tasks of science. Science is like a system of knowledge. The system of organization of scientific research. The system of training scientific personnel.
Chapter 2. *Research Methodology*
Methods of scientific research. Methods of empirical level of research. Methods of theoretical level of research. Basic rules for putting forward and testing a hypothesis. Requirements for new theories. Methods of theoretical and empirical levels of research. The main stages of scientific research.
Chapter 3. *Information retrieval in scientific research*
Scientific information and its organization. The most important sources of information in the field of ecology. Abstract information. Express Information. Patent Information. Patent search. Methods of working with scientific literature.
Chapter 4. *Mathematical design of the experiment*
Experiment planning and its tasks. Basic Concepts of the Mathematical Theory of Experiment Design. Full Factor Experiment. Fractional factor experiment.
Chapter 5. *Conducting experimental research*
General concepts of the experiment. Development and construction of laboratory installations. Organization and conduct of experimental research. Measurements, measuring instruments and their characteristics. Simulation of physical phenomena and technical devices.
Chapter 6. *Processing of the results of experimental studies and their design*
Statistical analysis of the results of the experiment. Determination of experiment errors. Detection of gross errors. Use of computers in scientific research. Preparation of experimental research results for publication. Design of an article, report, abstract. Depositing handwritten works. Special requirements for the design of materials of various scientific journals. Legislation of Ukraine on patenting. Registration and filing of an application for an invention, patent. Algorithm for solving inventive problems. Registration of research results in the form of a scientific report. Structure of the R&D report. Requirements for its design.

Training Materials & Resources

Basic

1. *Nosachova Yu.V., Ivanenko O.I., Radovenchyk Y.V. Osnovy naukovyi doslidzhennia [Fundamentals of scientific research]. Kyiv: Condor Publishing House, 2020. – 294 p. 130 p.*
2. *Promising areas of scientific research in environmental protection. Laboratory practicum. Helps. for students. specialty 101 "Ecology" / KPI them. Igor Sikorsky; compiled by T. O. Shabliy, Y. V. Nosachova, O. I. Ivanenko. – Electronic text data (1 file: 131 KB). – Kyiv: KPI them. Igor Sikorsky, 2022. – 86 p.*

Secondary

3. *Partyko Z. Osnovy naukovyi doslidzhennia [Fundamentals of scientific research]. Preparation of the dissertation. Kyiv: Lira-K, 2017. – 232 p.*
4. *Kolesnikov O. V. Osnovy naukovyi doslidzhennia [Fundamentals of scientific research]. Kyiv: CNL, 2019. – 144 p.*
5. *Anatoly Konversky. Fundamentals of methodology and organization of scientific research. Kyiv: CNL, 2019. – 350 p.*
6. *State Standard of Ukraine. DSTU 8302:2015 Information and documentation. Bibliographic reference. General Provisions and Rules of Drafting.*

Information resources on the Internet

https://www.grafiati.com/uk/
http://ukrlit.org/transliteratsiia#source=0jhqu9c+0yjqutc40l3qsa==
Professional Association of Ecologists of Ukraine (PAEU) - https://pae.com.ua/

Educational content

1. Methods of mastering the discipline (educational component)

Lectures

Lectures are aimed at:

- *providing up-to-date, holistic, interdependent knowledge in the discipline "Promising areas of scientific research in environmental protection", the level of which is determined by the target setting for each specific topic;*
- *ensuring the creative work of students together with the teacher during the lecture;*
- *education of students' professional and business qualities and development of their independent creative thinking;*
- *formation of students' necessary interest and providing direction for independent work;*
- *determination at the current level of development of science and technology in the field of environmental protection, forecasting their development for the coming years;*
- *reflection of methodical processing of the material (highlighting the main provisions, conclusions, recommendations, clear and adequate formulations of them);*
- *use of visual materials for demonstration, combination, if possible, with demonstration of results and samples;*
- *teaching research materials in a clear and high-quality language in compliance with structural and logical connections, explanation of all newly introduced terms and concepts;*
- *accessibility for perception by this audience.*

Salary No.	*Title of the topic of the lecture and a list of the main questions (list of didactic aids, references to literature and tasks for the SRS)*	*Number of hours*
1	***General information about the concept of science.*** *General information about science. The main tasks of science. Science is like a system of knowledge. [1, p. 6-21]. The system of organization of scientific research. The system of training scientific personnel. [3, p. 40-47], [4, p. 25-30], [5, p. 84-93]. Task for the SRS – To analyze the systems of training scientific personnel in different countries [1]*	***4***
2	***Methodology of scientific research.*** *Methods of scientific research. Methods of empirical level of research. Methods of theoretical level of research. Basic rules for putting forward and testing a hypothesis. Requirements for new theories. [1, p. 23-31]. Methods of theoretical and empirical levels of research. The main stages of scientific research. [3].* *Tasks on the CPS - The role of logical methods in scientific research. [5]*	***5***
3	***Information retrieval in scientific research*** *Scientific information and its organization. The most important sources of information in the field of ecology. [1, p. 50-67], [5, p. 49-66]. Abstract information. Express Information. Patent Information. Patent search. Methods of working with scientific literature [1].* *The task for the CPC is to analyze the concept and types of catalogs [3, 5].*	***5***
4	***Psychology of Scientific Creativity*** *Scientific thinking, methods of activating scientific thinking [5].*	***4***
	Just	*18*

Laboratory classes

In the system of professional training of students, laboratory classes occupy 87.5% of the classroom load. As a supplement to the lecture course, they lay and form the foundations of the Master's Degree in Ecology qualification. The purpose of laboratory and practical classes is to develop students' experimental skills, a research approach to the study of the subject, and consolidation of theoretical material.

Salary No.	*Name of the laboratory work (computer practicum)*	*Number of aud. Hours*

1	*Wastewater treatment from organic contaminants*	*12*
2	*Water Softening by Ion Exchange Method under Static Conditions*	*14*
3	*Study of the processes of equipment protection against corrosion*	*12*
4	*Ion Exchange Treatment of Wastewater from Heavy Metals on the Example of Chromium Ion Removal*	*12*
5	*Wastewater Treatment from Organic Substances by Ion Exchange Method*	*12*
6	*Destruction of wastewater polluted with organic matter*	*12*
7	*Stabilization of scale formation processes in an aqueous environment*	*14*
8	*The use of flocculants to improve the processes of keeping waste paper on the grid and dewatering the fibrous sludge of paper and cardboard industries*	*12*
9	*Removal of heavy metal ions by sorption on magnetite particles*	*12*
10	*Extraction of Nickel Ions from Spent Chemical Nickel Plating Solution*	*12*
11	*Modular test*	*2*
	Total Hours	*126*

Student's independent work

Independent work takes 46.7% of the time of studying the credit module, including preparation for the test. The main task of students' independent work is the acquisition of scientific knowledge, which is not included in the list of lecture questions, through personal search for information, the formation of an active interest in a creative approach in educational work.

Salary No.	*Name of the topic to be submitted for self-study*	*Number of CPC hours*
Chapter 1. General information about the concept of science		
1	*To analyze the systems of training scientific personnel in different countries [1]*	*25*
Chapter 2. Research Methodology		
2	*The Role of Logical Methods in Scientific Research. [5]*	*25*
Chapter 3. Information retrieval in scientific research		
3	*Analyze the concept and types of catalogs [3, 4].*	*25*
Chapter 4. Psychology of Scientific Creativity		
4	*The influence of external factors on thinking [5].*	*26*
5	*Preparation for the ICR*	*5*
6	*Exam Preparation*	*20*
	Total Hours	*126*

PROVISION OF PROGRAM RESULTS WITH THE COMPONENTS OF THE EDUCATIONAL COMPONENT

Name of PR	***Lectures***	***Laboratory Lessons, individual task***
Know and understand the fundamental and applied aspects of the environmental sciences	***General information about the concept of science.***	

Be able to use conceptual ecological patterns in professional activities	***General information about the concept of science.***	*Laboratory work 1 -11*
Know the basic concepts of natural science, sustainable development and methodology of scientific knowledge at the level of the latest achievements	***General information about the concept of science.***	*Laboratory work 1 -11*
Demonstrate the ability to organize collective activities and implement complex environmental projects, taking into account available resources and time constraints	***Research Methodology***	*Laboratory work 1 -11*
Be able to clearly and unambiguously convey professional knowledge, own justifications and conclusions to specialists and the general public	***Research Methodology***	*Laboratory work 1 -11*
Demonstrate awareness of the latest principles and methods of environmental protection	***Research Methodology***	*Laboratory work 1 -11*
Be able to use modern information resources on ecology, nature management and environmental protection	***Information retrieval in scientific research***	*Laboratory work 1 -11*
Be able to assess landscape and biological diversity and analyze the consequences of anthropogenic impact on natural environments	***Research Methodology***	*Laboratory work 1 -11*
Be able to assess the potential impact of man-made objects and economic activities on the environment	***Research Methodology***	*Laboratory work 1 -11*
Apply new approaches to develop a decision-making strategy in complex unpredictable environments	***Information retrieval in scientific research***	*Laboratory work 1 -11*
Assess environmental risks in the face of insufficient information and conflicting requirements	***Information retrieval in scientific research***	*Laboratory work 1 -11*
Choose the optimal strategy for managing and/or using natural resources depending on environmental conditions	***Information retrieval in scientific research Psychology of Scientific Creativity***	*Laboratory work 1 -11*
Critically comprehend theories, principles, methods and concepts from various subject areas to solve practical problems and problems of ecology	***Research Methodology Psychology of Scientific Creativity***	*Laboratory work 1 -11*

Be able to use modern methods of processing and interpretation of information when conducting innovative activities	***Research Methodology***	*Laboratory work 1 -11*
Be able to independently plan the implementation of an innovative task and formulate conclusions based on its results	***Information retrieval in scientific research General information about the concept of science.***	*Laboratory work 1 -11*
Know modern approaches to the organization of environmentally friendly production, reorganization and reconstruction of existing industries from the standpoint of resource saving, taking into account the life cycle of the product	***Information retrieval in scientific research General information about the concept of science. Psychology of Scientific Creativity***	*Laboratory work 1 -11*
Analyze the results of environmental control of enterprises' activities, assess the engineering and technical level of environmental protection from the harmful effects of production	***Information retrieval in scientific research General information about the concept of science. Psychology of Scientific Creativity***	*Laboratory work 1 -11*

Policy & Control

4. Academic discipline policy (educational component)

Rules for attending classes and behavior in the classroom

Students are obliged to take an active part in the educational process, not to be late for classes and not to miss them without a valid reason, not to interfere with the teacher's classes, not to be distracted by actions that are not related to the educational process.

Rules for assigning incentive and penalty points

Semester certification is conducted in the form of an exam. To assess learning outcomes, a 100-point rating system and a university scale are used.

Rules for assigning incentive and penalty points

- ***Incentive points can be awarded by the teacher only for the performance of creative work on the discipline or additional completion of online profile courses with the receipt of the appropriate certificate:***

https://prometheus.org.ua/course/course-v1:UKMA+SCDA101+2020_T1 Science Communication in the Digital Age

https://prometheus.org.ua/course/course-v1:Prometheus+DTI101+2017_T3 Design Thinking for Innovation

https://www.coursera.org/learn/research-methods Understanding Research Methods

It is not allowed to take the same course in different semesters. But their amount cannot exceed 10% of the rating scale.

- ***penalty points within the academic discipline are not provided****.*

Deadlines and retakes policy

In case of arrears in academic discipline or any force majeure, students must contact the teacher through the available (provided by the teacher) communication channels to resolve problematic issues and agree on an algorithm of actions for working out.

Academic Integrity Policy

Plagiarism and other forms of dishonest work are unacceptable. Plagiarism includes the lack of references when using printed and electronic materials, quotes, opinions of other authors. Inadmissible hints and

cheating when writing tests, conducting classes; passing a test for another student; copying copyrighted material without the permission of the author of the work.
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". Read more: https://kpi.ua/code
Academic Conduct and Ethics Policy
Students should be tolerant, respect the opinion of others, formulate objections in the correct form, and constructively maintain feedback in the classroom.
The norms of ethical behavior of 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". Read more: https://kpi.ua/code

5. Types of control and rating system for assessing learning outcomes (CRO)

Distribution of study time by types of classes and tasks from the credit module according to the working curriculum

Form teaching	Semesters	Total cr/hour	Distribution of study time by types of classes							Semester Certification
			Lecture	Practical classes	Seminars	Laboratory work	Compte- (a) To the	SRS	FDM	
Full-time/distant /mixed	autumn	9/270	18	-	-	126	-	126	1	Exam

** - in accordance with the number of students in the group, the number of lectures, practical and laboratory classes can be proportionally changed, taking into account individual classes*

1. The student's rating in the credit module is calculated from 100 points, of which 52 points are the starting scale. The starting rating (during the semester) consists of the points that the student receives for:
- performing 10 laboratory works;
- performance of modular control work (MCR is divided into 2 works lasting 45 minutes each).
2. Scoring criteria.
2.1. ***Laboratory work****:*
– impeccable work – 4 points;
– there are certain deficiencies in the preparation and/or performance of work – 3-1 points;
– absence from class without valid reasons – -1 point.
2.2. ***Tests are evaluated in 6 points****:*
– "excellent" – complete answer (at least 90% of the required information) – 6-5 points;
– "good" – a fairly complete answer (at least 75% of the required information), or a complete answer with minor inaccuracies – 4-3 points;
– "satisfactory" – incomplete answer (at least 60% of the required information) and minor errors – 2-1 points;
– "unsatisfactory" – the answer does not meet the requirements for "satisfactory" – 0 points.

3. The condition for the first certification is to receive at least 8 points. The condition for the second certification is to receive at least 22 points.
4. The condition for admission to the exam is the enrollment of at least one part of the test, 6 laboratory works, starting rating of at least 26 points.

5. At the exam, students complete a written test. Each task contains two theoretical questions (tasks) and one practical one. The list of questions is given in the Recommendations for mastering the credit module. Each question (task) is worth 16 points according to the following criteria:
– "excellent", complete answer, at least 90% of the required information (complete, error-free solution of the problem) – 16-10 points;
– "good", a sufficiently complete answer, at least 75% of the required information or minor inaccuracies

(complete solution of the problem with minor inaccuracies) – 9-5 points;
– "satisfactory", incomplete answer, at least 60% of the required information and some errors (the task was completed with certain shortcomings) – 4-1 points;
– "unsatisfactory", the answer does not meet the conditions for "satisfactory" – 0 points.

6. The sum of starting points and points for the examination test is transferred to the examination grade according to the table:

Points: Laboratory work + MKR + examination work	*Score*
100… 95	*Perfectly*
94… 85	*Very good*
84… 75	*Well*
74… 65	*Satisfactory*
64… 60	*Enough*
Less than 60	*Disappointing*
Unfinished labs	*Not allowed*

6. Additional information on the discipline (educational component)

QUESTIONS FOR THE MODULE TEST

1. *To characterize the measuring instruments and their characteristics.*
2. *Define patent search.*
3. *To provide an algorithm for organizing and conducting experimental research.*
4. *Provide a methodology for working with scientific literature.*
5. *Give general concepts about the experiment.*
6. *To characterize the use of computing technology to process the results of scientific research.*
7. *To characterize the GID program.*
8. *To give the tasks of cultivating creative abilities.*
9. *To give the main directions of scientific and technological progress.*
10. *Describe the formal features of a scientist.*
11. *Analyze the use of the Internet to search for professional information.*
12. *Provide an algorithm for constructing nomograms.*
13. *To characterize approximate solutions.*
14. *To present the scope of applied research in ecology and its ultimate goal.*
15. *Bring university scientific organizations.*
16. *To characterize research interns as a form of scientific training.*
17. *Bring sectoral scientific organizations.*
18. *Describe the training of personnel in graduate school.*
19. *Describe the training of personnel in doctoral studies.*
20. *Characterize the generalization of the results of scientific work.*

EXAM QUESTIONS

1. *To define the concept of genesis of science studies.*
2. *Describe the essence and classification of science.*
3. *Give the structure and classification of science.*
4. *To reveal the historical aspect and modern priorities of science.*
5. *To give the stages of the development of science.*
6. *To give the main stages of the history of Ukrainian science.*
7. *To determine the activities of the National Academy of Sciences of Ukraine.*

8. *Lead the staffing of scientific research.*
9. *To give the concept of objects of scientific research and their classification.*
10. *Identify general scientific and empirical research methods.*
11. *Describe the current scientific priorities of Ukraine.*
12. *Lead the ways of integration and differentiation in science. Reasons that led to the development of technical translation.*
13. *Describe the organizational structure of scientific research in Ukraine.*
14. *Lead the organizational sectors of science.*
15. *To define the concepts of methodology, method, methodology in scientific research.*
16. *To bring the structure of the methodological apparatus of scientific research.*
17. *To describe the systematic approach and relationships in science.*
18. *To reveal the essence of the phenomena of continuity and ethics in science.*
19. *To give a definition of the hypothetico-deductive method of scientific research.*
20. *Describe the method of oppositions in research.*
21. *To give the features of scientific knowledge: essence, objects, subjects.*
22. *To cite the methods of scientific knowledge.*
23. *Provide a scheme for conducting scientific research.*
24. *Determine the main stages of drawing up a research schedule.*
25. *To present the main forms of generalization of research results.*
26. *To provide methods for determining the relationships between factors and phenomena.*
27. *Dates, forms of completion and presentation of the results of scientific research.*
28. *To characterize the concept of scientific publication.*
29. *To give the concept of a scientific monograph, a scientific article, an abstract.*
30. *Determine the order of practical implementation of the research results.*
31. *To give the essence of the concept of effectiveness of scientific research.*
32. *To give the essence of the concept of "information", its essence, role and typology.*
33. *To characterize the effectiveness of the results of scientific research and its criteria.*
34. *To provide the main components and stages of calculating the economic efficiency of scientific research.*
35. *To give a classification of information support for scientific research.*
36. *To reveal the concept of factual information and its use in the research process.*
37. *Describe the method of searching for primary sources.*
38. *Give the stages of training scientific personnel.*
39. *To reveal the concept of degree education in Ukraine: scientific degrees of the present.*
40. *To characterize the peculiarities of the training of scientific personnel in Ukraine in the light of the entry into the Bologna Process.*

Work program of the discipline (syllabus):
Compiled by *Assoc. Prof., Ph.D., Nosachova Y.V.*
Approved *by the Department of ___E and TRP___ (Minutes No. 17 dated 23/05/2024)*
Approved *by the IHF Methodological Commission (Minutes No. 11 dated 06/28/2024)*