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

Ecology and Technology of Plant Polymers

PERSPECTIVE RESEARCH DIRECTIONS IN ENVIRONMENTAL PROTECTION. PART 2. THEORETICAL AND EXPERIMENTAL SOLUTION OF SCIENTIFIC PROBLEMS IN ENVIRONMENTAL SAFETY

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)/mixed*
Year of preparation, semester	*1 year, spring semester*
Scope of discipline	*6/(180)*
Semester control / control measures	*Passed*
Timetable	*4 hours per week (1 hour of practical classes / 3 hours of laboratory classes)*
Language of instruction	*Ukrainian*
Information about Course Leader / Instructors	*Teacher: https://eco-paper.kpi.ua/pro-kafedru/vykladachi/nosachova-yuliya-viktorivna.html*
Course Placement	*https://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 learn and master modern knowledge*

1.2. The main tasks of the discipline.

According to the requirements of the educational-professional and educational-scientific program, students must demonstrate the following learning outcomes after mastering the discipline:

- *Know and understand the fundamental and applied aspects of 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*
- *Analyze the results of environmental control of enterprises' activities, assess the engineering and technical level 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)

The discipline "Promising areas of scientific research in environmental protection" is preceded by academic disciplines, such as: "Promising areas of scientific research in environmental protection. Part 1. Analysis of Current Problems of Environmental Protection". The academic discipline

"Promising areas of scientific research in environmental protection" provides the discipline "Promising areas of scientific research in environmental protection. Term paper", master's thesis.

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)

Laboratory classes

In the system of professional training of students, laboratory classes occupy 75% of the classroom load. 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	*Extraction of copper ions from water by electrochemical methods.*	*6*
2	*Electrochemical Extraction of Nickel Ions from Spent Nickel Plating Solutions*	*8*
3	*The use of clinoptelolite for water purification from organic impurities*	*6*
4	*Use of sodium aluminate waste for reagent water softening*	*6*
5	*The Use of (VI) Alkali Metal Ferrates to Purify Water from Suspended Solids*	*8*
6	*Removal of petroleum products from water by magnetic-sorption method*	*6*
7	*Investigation of the processes of utilization of iron-containing wastewater*	*8*
8	*Research of the processes of obtaining pressed materials from production waste*	*6*
	Total Hours	*54*

Practical classes

In the system of professional training of students in this discipline, practical classes occupy 25% 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 content of these classes and the methods of their conduct should ensure the development of the creative activity of the individual. They develop scientific thinking and the ability to use special terminology, allow you to test knowledge, so this type of work is an important means of operational feedback. Practical classes should perform not only cognitive and educational functions, but also contribute to the growth of students as creative workers in the field of environmental protection.

The main tasks of the cycle of practical classes:

- *to help students systematize, consolidate and deepen theoretical knowledge in the field of modern principles of formation of the content of innovation activity;*
- *to teach students the techniques of solving practical problems, to promote the mastery of skills and abilities to perform calculations, graphic and other tasks;*
- *teach them to work with scientific and reference literature and regulatory documents;*
- *to form the ability to learn independently, that is, to master the methods, ways and techniques of self-study, self-development and self-control.*

Salary No.	***Title of the topic of the practical lesson and a list of the main questions (list of didactic support, links to literature and tasks for the SRS)***	***Hours***
1	**Topic 1.** *Genesis of science and scientific activity: from proto-scientific knowledge to modern research [1, 4].* ***Task for the SRS:*** *To analyze the systems of training scientific personnel in different countries [1 p. 35-38, 4 p. 182-187]*	***4***
2	**Topic 2.** *The process of scientific research, its characteristics and stages of conduct [1, 4].* ***Tasks for the CPS****: The role of logical methods in scientific research. [4 vv. 28-29]*	***4***
3	**Topic 3.** *Information support of scientific research [1, 4].*	***4***

	***Task for the CPS**: To analyze the concept and types of catalogs [2, p. 66-69, 4, p. 10-13].*	
4	**Topic 1.** *Technological features of scientific research [1, 4].* ***CPS Task**: The Influence of External Factors on Thinking [1, pp. 5-8].*	***4***
5	***Passed***	***2***
	Just	***18***

Student's independent work

Independent work takes 60% 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 p. 35-38, 4 p. 182-187]*	*25*
Chapter 2. Research Methodology		
2	*The Role of Logical Methods in Scientific Research. [4 vv. 28-29]*	*25*
Chapter 3. Information retrieval in scientific research		
3	*Analyze the concept and types of catalogs [2, p. 66-69, 4, p. 10-13].*	*26*
Chapter 4. Conducting experimental research. Processing of experimental research results		
4	*The Influence of External Factors on Thinking [4, pp. 5-8].*	*26*
5	*Preparation for the test*	*6*
	Total Hours	***108***

PROVISION OF PROGRAM RESULTS WITH THE COMPONENTS OF THE EDUCATIONAL COMPONENT

Name of PR	***Practical classes***	***Laboratory Lessons, individual task***
Know and understand the fundamental and applied aspects of the environmental sciences	*Practical lessons 1-4*	*Labs 1 - 8*

Be able to use conceptual ecological patterns in professional activities	*Practical lessons 1-4*	*Labs 1 - 8*
Know the basic concepts of natural science, sustainable development and methodology of scientific knowledge at the level of the latest achievements	*Practical lessons 1-4*	*Labs 1 - 8*
Demonstrate the ability to organize collective activities and implement complex environmental projects, taking into account available resources and time constraints	*Practical lessons 1-4*	*Labs 1 - 8*
Be able to clearly and unambiguously convey professional knowledge, own justifications and conclusions to specialists and the general public	*Practical lessons 1-4*	*Labs 1 - 8*
Demonstrate awareness of the latest principles and methods of environmental protection	*Practical lessons 1-4*	*Labs 1 - 8*
Be able to use modern information resources on ecology, nature management and environmental protection	*Practical lessons 1-4*	*Labs 1 - 8*
Be able to assess landscape and biological diversity and analyze the consequences of anthropogenic impact on natural environments	*Practical lessons 1-4*	*Labs 1 - 8*
Be able to assess the potential impact of man-made objects and economic activities on the environment	*Practical lessons 1-4*	*Labs 1 - 8*
Apply new approaches to develop a decision-making strategy in complex unpredictable environments	*Practical lessons 1-4*	*Labs 1 - 8*
Assess environmental risks in the face of insufficient information and conflicting requirements	*Practical lessons 1-4*	*Labs 1 - 8*
Choose the optimal strategy for managing and/or using natural resources depending on environmental conditions	*Practical lessons 1-4*	*Labs 1 - 8*
Critically comprehend theories, principles, methods and concepts from various subject areas to solve practical problems and problems of ecology	*Practical lessons 1-4*	*Labs 1 - 8*
Be able to use modern methods of processing and interpretation of information when conducting innovative activities	*Practical lessons 1-4*	*Labs 1 - 8*
Be able to independently plan the implementation of an innovative task and formulate conclusions based on its results	*Practical lessons 1-4*	*Labs 1 - 8*

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	*Practical lessons 1-4*	*Labs 1 - 8*
Analyze the results of environmental control of enterprises' activities, assess the engineering and technical level of environmental protection from the harmful effects of production	*Practical lessons 1-4*	*Labs 1 - 8*

Policy & Control

2. Academic discipline policy (educational component)

Rules for attending classes and behavior in the classroom

Attendance at classes is a mandatory component of the assessment. 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 carried out in the form of a credit. 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: Science Communication in the Digital Age*

https://courses.prometheus.org.ua/courses/course-v1:Prometheus+DTI101+2017_T3/about 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.

- *There are no penalty points within the academic discipline.*

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

3. 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 Training	Semesters	Total cr/hour	Distribution of study time by types of classes						Semester Certification
			Lecture	Practical classes	Seminars	Laboratory work	Computer-(a) To the exten	SRS	
Day	Spring	6/180	-	18	-	54	-	108	Passed

1. A student's rating in a credit module consists of the points that he/she receives for:
- 8 laboratory works;

2. ***Scoring criteria****.*
2.1. Laboratory work*:*
– impeccable work – 8 points;
– there are certain deficiencies in the preparation and/or performance of work – 7-1 points;
– absence from class without a valid reason – 0 points.

2.2. The test *is evaluated out of 36 points.*
The control task of this work consists of two questions from the list provided in the annex to the work program of the CM.
Each question is scored out of 18 points according to the following criteria:
– "excellent", complete answer (at least 90% of the required information) – 18-10 points;
– "good", a fairly complete answer (at least 75% of the required information, or minor inaccuracies) – 9-6 points;
– "satisfactory", incomplete answer (at least 60% of the required information and some errors) – 5-1 points;
– "unsatisfactory", the answer does not meet the conditions for "satisfactory" – 0 points.

3. The condition for the first certification *is to receive at least 24 points. The condition for the second certification is to receive at least 45 points.*

4. The sum of rating points *received by the student during the semester is transferred to the final grade according to the table. If the sum of points is less than 60, the student completes a test work. In this case, the sum of points for writing tests and test papers is transferred to the final grade according to the table.*

5. A student who received at least 60 points in the semester can take part in the test work. In this case, the points received by him on the test are final.

6. Table of conversion of rating points to grades.

Points: *Automatic: 100% Lab Performance* *or* *Credit: Test work + 70% of laboratory 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*

4. Additional information on the discipline (educational component)

Questions for the 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.*

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)*