



National Technical University of Ukraine  
"Igor Sikorsky Kyiv Polytechnic Institute"



Ecology and technology of  
plant polymers

**Perspective Research Directions in Environmental Protection. Part 2. Theoretical and Experimental Solution of Scientific Problems in Environmental Safety**  
**Working program of the discipline (Syllabus)**

**Details of the discipline**

<b>Level of higher education</b>	<i>Second (Master's)</i>
<b>Branch of knowledge</b>	<i>10 Natural sciences</i>
<b>Speciality</b>	<i>101 Ecology</i>
<b>Educational program</b>	<i>Environmental safety</i>
<b>Status of discipline</b>	<i>Normative</i>
<b>Form of training</b>	<i>full-time/mixed</i>
<b>Year of preparation, semester</b>	<i>1 course, spring semester</i>
<b>Volume of discipline</b>	<i>3,5/(105)</i>
<b>Semester control/ control measures</b>	<i>Final test</i>
<b>Schedule of classes</b>	<i>1 hour and tyzhden (1 hour and laboratory classes)</i>
<b>Language of instruction</b>	<i>Ukrainian</i>
<b>Information about the course /teachers</b>	<i>Teacher: <a href="https://eco-paper.kpi.ua/pro-kafedru/vykladachi/nosachova-yuliya-viktorivna.html">https://eco-paper.kpi.ua/pro-kafedru/vykladachi/nosachova-yuliya-viktorivna.html</a></i>
<b>Course placement</b>	<i><a href="https://do.ipk.kpi.ua/course/view.php?id=2151">https://do.ipk.kpi.ua/course/view.php?id=2151</a></i>

## Program of discipline

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

#### 1.1. The purpose of the discipline.

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

- The ability to learn and master modern knowledge
- The ability to generate new ideas (creativity)
- The ability to search, process and analyze information from various sources
- The ability to develop and improve methods and technologies
- Awareness at the level of the latest achievements, necessary for research and/or innovative activities in the field of ecology, environmental protection and balanced nature management

The ability to use the principles, methods and organizational procedures of research and/or innovation activities

- The ability to organize works related to the assessment of the environmental state, environmental protection and optimization of nature management, in conditions of incomplete information and conflicting requirements

#### 1.2. The main tasks of the discipline.

In accordance with the requirements of the educational, professional and educational-scientific program, students after mastering the discipline must demonstrate the results of training:

- To know and understand the fundamental and applied aspects of environmental sciences
  - To be able to use conceptual environmental patterns in professional activities
  - To know at the level of the latest achievements the basic concepts of natural science, sustainable development and methodology of scientific knowledge
  - To demonstrate the ability to organize collective activities and implement complex environmental projects, taking into account available resources and time constraints
  - To be able to communicate professional knowledge, own justifications and conclusions to specialists and the general public clearly and unambiguously
  - To demonstrate awareness of the latest principles and methods of environmental protection
  - To be able to use up-to-date information resources on ecology, nature management and environmental protection
  - To be able to assess landscape and biological diversity and analyze the effects of anthropogenic impact on the environment
  - To be able to assess the potential impact of man-made objects and economic activities on the environment
- To apply new approaches to develop decision-making strategies in complex unpredictable conditions
- To assess environmental risks in the conditions of insufficient information and conflicting requirements
  - To choose the optimal management strategy and/or nature management depending on ecological conditions
  - To critically comprehend theories, principles, methods and concepts from various subject areas to solve practical problems and problems of ecology
- To be able to use modern methods of processing and interpretation of information in innovative activities
- To be able to independently plan the implementation of an innovative task and formulate conclusions based on its results
  - To know up-to-date approaches to the organization of environmentally cleaner production, reorganization and reconstruction of existing production from the standpoint of resource conservation, taking into account the life cycle of the product

To analyze the results of environmental control of companies, assess the engineering and technical level of environmental protection measures against the harmful effects of production

#### **Prerequisite and requisition disciplines (place in the structural and logical scheme of training according to the relevant educational program)**

The discipline "Perspective areas of scientific research in environmental protection" is preceded by academic disciplines, such as: "Chemistry with the basics of biogeochemistry", "Analytical chemistry", "Technology and equipment of atmospheric protection", "Disposal and recovery of waste", "Membrane methods of water purification", "Physicochemical bases of water purification processes by coagulation", "Sorption and ion exchange in water purification technologies", "Water purification by flotation", who studied during their studies at the bachelor's degree. The educational discipline "Promising directions of scientific research in environmental protection" provides the disciplines

"Fundamentals of metrology and theory of errors", "Processing of scientific and technical information", "Resource-efficient and waste-free technologies", "Certification and control of environmental protection", execution of a master's thesis.

#### CONTENT OF EDUCATIONAL MATERIAL

Section 1. General information about the concept of science.

General information about the concept of science. The main tasks of science. Science as a system of knowledge. System of organization of scientific research. System of training of scientific personnel.

Section 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 the hypothesis. Requirements for new theories. Methods of theoretical and empirical levels of research. The main stages of scientific research.

Section 3. Information search 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.

Section 4. Mathematical planning of the experiment

Planning experiments and their tasks. Basic concepts of mathematical theory of experiment planning. A complete factor experiment. Fractional factor experiment.

Section 5. Conducting experimental research

General concepts about the experiment. Development and design of laboratory installations. Organization and conduct of experimental research. Measurements, measuring instruments and their characteristics. Modeling of physical phenomena and technical devices.

Section 6. Processing the results of experimental studies and their design

Statistical analysis of the results of the experiment. Determination of errors of the experiment. Detection of gross errors. The use of COMPUTER in scientific research. Preparation of the results of experimental research for publication. Registration of the article, reports, abstracts. Deposit of 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. The structure of the report on the GDR. Requirements for its design.

#### Educational materials and resources

##### Basic

1. Nosachova Yu.V., Ivanenko O.I., Radovenchuk Ya.V. Basics of the scientific research. Kyiv: "Condor" Publishing House, 2020. - 294 p. 130 p.

2. Prospective directions of scientific research in environmental protection. Laboratory practicum [Electronic resource]: teaching. manual for students specialty 101 "Ecology" / KPI named after Igor Sikorskyi; edited by: T. O. Shablui, Yu. V. Nosachova, O. I. Ivanenko. – Electronic text data (1 file: 131 kbytes). – Kyiv: KPI named after Igor Sikorskyi, 2022. – 86 p.

##### Auxiliary

3. Partyko Z. Fundamentals of scientific research. Dissertation preparation. - K.: Lira-K, 2017. - 232 p.

4. Kolesnikov O.V. Fundamentals of scientific research. - K.: TsNL, 2019. - 144 p.

5. Anatoly Konverskyi. Basics of methodology and organization of scientific research. - K.: TsNL, 2019. - 350 p.

6. State standard of Ukraine. DSTU 8302:2015 Information and documentation. Bibliographic reference. General provisions and rules of compilation.

#### Information resources on the Internet

<https://www.grafiati.com/uk/>

<http://ukrlit.org/transliteratsiia#source=0jhqu9c+0yjquctc40l3qsa==>

Professional Association of Environmentalists 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 17% of the classroom load. The purpose of laboratory and practical classes is to develop students' experimental skills, a research approach to the study of the subject, and the consolidation of theoretical material.

No s/n	Name of laboratory work (computer workshop)	The number of aud. Hours
1	Extraction of copper ions from water by electrochemical methods.	2
2	Electrochemical extraction of nickel ions from waste nickel plating solutions	2
3	Use of cuneoptelolite for water purification from organic impurities	2
4	Use of sodium aluminate waste for reagent water softening	2
5	Use of alkali metal ferrates (VI) to purify water from suspended solids	2

6	<i>Removal of petroleum products from water by the magneto-sorption method</i>	2
7	<i>Investigation of iron-containing wastewater disposal processes</i>	2
8	<i>Investigation of the processes of obtaining pressed materials from production waste</i>	2
9	<i>Passed</i>	2
	<b>Total hours</b>	<b>18</b>

#### Independent work of the student

Independent work takes 83% of the time to study the credit module, including preparation for the test. The main task of independent work of students is the mastery of scientific knowledge, which is not included in the list of lecture issues, through personal search for information, the formation of an active interest in the creative approach in educational work.

No s/p	Name of the topic submitted for self-study	Number of hours of IWS
<i>Section 1. General information about the concept of science</i>		
1	<i>Analyze the systems of training of scientific personnel in different countries [1 p. 35-38, 4 p. 182-187]</i>	22
<i>Section 2. Methodology of scientific research</i>		
2	<i>The role of logical methods in scientific research. [11 art. 28-29]</i>	20
<i>Section 3. Information search in scientific research</i>		
3	<i>Analyze the concepts and types of catalogs [2, p. 66-69, 11 p. 10-13].</i>	20
<i>Section 4. Conducting experimental research. Processing the results of experimental studies</i>		
4	<i>The influence of external factors on thinking [11, art. 5-8].</i>	19
5	<i>Preparation for the standings</i>	6
	<b>Total hours</b>	<b>87</b>

#### Politics and control

#### *Provision of program results by components of the educational component*

<b>Program results</b>	<b>Lecture classes</b>	<b>Laboratory lessons, individual task</b>
<i>To know and understand the fundamental and applied aspects of environmental sciences</i>		<i>Laboratory works 1 -8</i>

<i>To be able to use conceptual environmental patterns in professional activities</i>		<i>Laboratory works 1 -8</i>
<i>To know at the level of the latest achievements the basic concepts of natural science, sustainable development and methodology of scientific knowledge</i>		<i>Laboratory works 1 -8</i>
<i>To demonstrate the ability to organize collective activities and implement complex environmental projects, taking into account available resources and time constraints</i>		<i>Laboratory works 1 -8</i>
<i>To be able to communicate professional knowledge, own justifications and conclusions to specialists and the general public clearly and unambiguously</i>		<i>Laboratory works 1 -8</i>
<i>To demonstrate awareness of the latest principles and methods of environmental protection</i>		<i>Laboratory works 1 -8</i>
<i>To be able to use up-to-date information resources on ecology, nature management and environmental protection</i>		<i>Laboratory works 1 -8</i>
<i>To be able to assess landscape and biological diversity and analyze the effects of anthropogenic impact on the environment</i>		<i>Laboratory works 1 -8</i>
<i>To be able to assess the potential impact of man-made objects and economic activities on the environment</i>		<i>Laboratory works 1 -8</i>
<i>To apply new approaches to develop decision-making strategies in complex unpredictable conditions</i>		<i>Laboratory works 1 -8</i>
<i>To assess environmental risks in the conditions of insufficient information and conflicting requirements</i>		<i>Laboratory works 1 -8</i>
<i>To choose the optimal management strategy and/or nature management depending on ecological conditions</i>		<i>Laboratory works 1 -8</i>
<i>To critically comprehend theories, principles, methods and concepts from various subject areas to solve practical problems and problems of ecology</i>		<i>Laboratory works 1 -8</i>
<i>To be able to use modern methods of processing and interpretation of information in innovative activities</i>		<i>Laboratory works 1 -8</i>
<i>To be able to independently plan the implementation of an innovative task and formulate conclusions based on its results</i>		<i>Laboratory works 1 -8</i>
<i>To know up-to-date approaches to the organization of environmentally cleaner production, reorganization and reconstruction of existing production from the standpoint of resource conservation, taking into account the life cycle of the product</i>		<i>Laboratory works 1 -8</i>

## **2. Policy of discipline (educational component)**

### **Rules for attending classes and behavior in classes**

Attending classes is a mandatory component of 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 good reason, not to interfere with the teacher to conduct 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 standings. To assess the results of training, a 100-point rating system and a university scale are used.

Rules for assigning incentive and penalty points

-encouraging points can be credited by the teacher only for the performance of creative works in the discipline or additional passage of online specialized courses with the receipt of the appropriate certificate:

[https://courses.prometheus.org.ua/courses/course-v1:UKMA+SCDA101+2020\\_T1/about](https://courses.prometheus.org.ua/courses/course-v1:UKMA+SCDA101+2020_T1/about) Scientific Communication in the Digital Age

[https://courses.prometheus.org.ua/courses/course-v1:Prometheus+DTI101+2017\\_T3/about](https://courses.prometheus.org.ua/courses/course-v1:Prometheus+DTI101+2017_T3/about) Design Thinking for Innovation

<https://www.coursera.org/learn/research-methods> Ponymanie methods of issuedovania

It is not allowed to take one course in different semesters.

But their amount can not exceed 10% of the rating scale.

-penalty points within the discipline are not provided.

### Deadline and overlay policy

In case of debts in the discipline or any force majeure circumstances, students should contact the teacher through accessible (provided by the teacher) communication channels to solve problematic issues and coordinate the algorithm of actions for working out.

### Academic Integrity Policy

Plagiarism and other forms of dishonest work are unacceptable. Plagiarism includes the absence of references when using printed and electronic materials, quotes, opinions of other authors. Invalid hints and write-offs when writing tests, conducting classes; passing the credit for another student; copying of materials protected by the copyright system without the permission of the author of the work.

The policies 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>

### Policy of academic behavior and ethics

Students should be tolerant, respect the opinion of others, object to formulate in the correct form, 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 (RCOs)

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

Form teaching	Semesters	Total kr/hour	Distribution of teaching time by type of classes						Semester certification
			Lecture	Practical classes	Seminars	Laboratory work	Computer worksho	IWS	
Day	Spring	3,5/105	-	-	-	18	-	87	Final test

1. The student's rating from the credit module consists of points that he receives for:

- performance of 8 laboratory works;

2. Criteria for scoring.

2.1. Laboratory work:

– impeccable work – 8 points;

– there are certain shortcomings in the preparation and / or performance of work – 7-1 points;

– absence from class without good reason – 0 points.

2.2. Scoring control work is evaluated with 36 points.

Each question is evaluated from 18 points according to the following criteria:

– "excellent", full answer (at least 90% of the necessary information) – 1 8-10 points;

– "good", a sufficiently complete answer (at least 75% of the necessary information, or minor inaccuracies) – 9-6 points;

– "satisfactory", incomplete answer (at least 60% of the necessary information and some errors) – 5-1 points;

– "unsatisfactory", the answer does not meet the conditions for "satisfactory" – 0 points.

3. The condition of the first certification is to receive at least 24 points.
4. The amount of rating points received by the student during the semester is transferred to the final assessment according to the table. If the amount of points is less than 60, the student performs scoring control work. In this case, the amount of points for writing control works and scoring control work is transferred to the final assessment according to the table.
4. A student who received at least 60 points in the semester can take part in the scoring control work. In this case, the points received by him at the control work are final.
5. Table of transfer of rating points to ratings.

<i>Points:</i>	<i>Score</i>
<i>Automatic: laboratory work 100%</i>	
<i>or</i>	
<i>Credit: Scoring control work + performance of 70% of laboratory work</i>	
<i>100... 95</i>	<i>Perfectly</i>
<i>94... 85</i>	<i>Very good</i>
<i>84... 75</i>	<i>Well</i>
<i>74... 65</i>	<i>Satisfactory</i>
<i>64... 60</i>	<i>Enough</i>
<i>Less than 60</i>	<i>Disappointing</i>
<i>Unfulfilled laboratory work</i>	<i>Not allowed</i>

#### **4. Additional information on the discipline (educational component)**

##### *Questions for scoring*

1. Give a description of the measuring instruments and their characteristics.
2. Determine the patent search.
3. To cite the algorithm for organizing and conducting experimental research.
4. To bring the methodology of work with scientific literature.
5. Give general concepts about the experiment.
6. Describe the use of computer technology to process the results of scientific research.
7. Give a description of the GUIDE program.
8. Give the task of education of creative abilities.
9. To give the main directions of scientific technological progress.
10. Describe the formal features of the scientist.
11. Analyze the use of the Internet to search for professional information.
12. Give an algorithm for constructing nomograms.
13. Give a description of approximate solutions.
14. To give the scope of applied research in ecology and its ultimate goal.
15. Bring university scientific organizations.
16. Describe trainee researchers as a form of training of scientific personnel.
17. Bring industry scientific organizations.
18. Describe the training of personnel in graduate school.
19. Describe the training in doctoral training.
20. Characterize the generalization of the results of scientific work.

##### **Work program of the discipline (syllabus):**

**Compiled** assoc., Ph.D., Nosachova Yu.V.

**Approved** by the Department E and TRP (protocol No. 14 of 18.05.2023)

**It was approved** by the IHF Dich Commission (Protocol No. 10 of 26.05.2023)