



Perspective Research Directions in Environmental Protection. Part 1. Analysis of Actual Problems of Environmental Protection
Working program of the discipline (Syllabus)

Details of the discipline

Level of higher education	<i>Second (Master's)</i>
Branch of knowledge	<i>10 Natural sciences</i>
Speciality	<i>101 Ecology</i>
Educational program	<i>Environmental safety</i>
Status of discipline	<i>Normative</i>
Form of training	<i>full-time/remote/mixed</i>
Year of preparation, semester	<i>1 course, autumn semester</i>
Volume of discipline	<i>10,5/(315)</i>
Semester control/ control measures	<i>Exam</i>
Schedule of classes	<i>8 hours per week (1 hour and lectures and 7 hours of laboratory classes)</i>
Language of instruction	<i>Ukrainian</i>
Information about the course /teachers	Lecturer: https://eco-paper.kpi.ua/pro-kafedru/vykladachi/nosachova-yuliya-viktorivna.html
Course placement	https://do.ipk.kpi.ua/course/view.php?id=2151

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;
- The awareness at the level of the latest achievements necessary for research and / or innovation 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)

Lecture classes

Lectures are aimed at:

- providing modern, holistic, interdependent knowledge in the discipline "Perspective areas of scientific research in environmental protection", the level of which is determined by the target setting for each specific topic;
- ensuring in the process of lecturing the creative work of students together with the teacher;
- education of students of professional and business qualities and development of their independent creative thinking;
- formation of the necessary interest in students 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;

- display of methodological processing of the material (allocation of the main provisions, conclusions, recommendations, clear and adequate to their formulations);
- use for demonstration of visual materials, combining, if possible, them with the demonstration of results and samples;
- teaching research materials in a clear and high-quality language in compliance with structural and logical relations, explaining all the newly introduced terms and concepts;
- accessibility for perception by this audience.

No s/p	The name of the lecture topic and the list of main issues (list of didactic means, references to literature and tasks on the IWS)	Number of hours
1	General information about the concept of science. General information about science. The main tasks of science. Science as a system of knowledge. [1, p. 6-21]. System of organization of scientific research. [2, p. 40-47], [4, p. 25-30], [10, p. 84-93]. Tasks at the IWS – To analyze the systems of training of 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 the hypothesis. Requirements for new theories. [1, p. 23-31]. Methods of theoretical and empirical levels of research. The main stages of scientific research. [3, p. 37-67]. The task at the IWS is the role of logical methods in scientific research. [9, 31-49]	5
3	Information search in scientific research Scientific information and its organization. The most important sources of information in the field of ecology. [1, p. 50-67], [9, p. 49-66]. Abstract information. Express information. Patent information. Patent search. Methods of working with scientific literature [12]. The task at the IWS is to analyze the concepts and types of catalogs [2, 11].	5
4	Psychology of scientific creativity Scientific thinking, methods of activation of scientific thinking [11, art. 5-8].	4
	Total hours	18

Laboratory classes

In the system of professional training of students, laboratory classes occupy 40% of the classroom load. Being an addition to the lecture course, they lay and form the basics of the Master's qualification in Ecologist Ia. The purpose of laboratory and practical classes is to develop students' experimental skills, research approach to the study of the subject, consolidation of theoretical material.

No s/n	Name of laboratory work (computer workshop)	The number of aud. Hours
1	Wastewater treatment from organic contaminants	12
2	Water softening by the ion exchange method under static conditions	14
3	Study of the processes of protecting equipment from corrosion	12
4	Ion exchange treatment of wastewater from heavy metals on the example of the removal of chromium ions	12
5	Wastewater treatment from organic matter by the ion exchange method	12
6	Destruction of wastewater contaminated with organic matter	12
7	Stabilization of scale formation processes in the aquatic environment	14
8	The use of flocculants to improve the processes of retaining waste paper on the grid and dehydration of fibrous sediment in paper and cardboard production	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 control work	2
	Total hours	126

Independent work of the student

Independent work takes 55% 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
Section 1. General information about the concept of science		
1	Analyze the systems of training of scientific personnel in different countries [1 p. 7-9]	35
Section 2. Methodology of scientific research		
2	The role of logical methods in scientific research. [9, 31-49]	35
Section 3. Information search in scientific research		
3	Analyze the concepts and types of catalogs [2, p. 66-69, 11 p. 10-13].	35
Section 4. Psychology of scientific creativity		
4	The influence of external factors on thinking [11, art. 5-8].	36

5	Preparation for the exam	30
	Total hours	171

Politics and control

2. Policy of discipline (educational component)

Rules for attending classes and behavior in classes

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 an exam. 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 Scientific 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> 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>

Provision of program results by components of the educational component

Program results	Lecture classes	Laboratory lessons, individual task
To know and understand the fundamental and applied aspects of environmental sciences	General information about the concept of science.	Laboratory works 1 -11

<i>To be able to use conceptual environmental patterns in professional activities</i>	<i>General information about the concept of science.</i>	<i>Laboratory works 1 -11</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>Methodology of scientific research</i>	<i>Laboratory works 1 -11</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>Methodology of scientific research</i>	<i>Laboratory works 1 -11</i>
<i>To be able to communicate professional knowledge, own justifications and conclusions to specialists and the general public clearly and unambiguously</i>	<i>Methodology of scientific research</i>	<i>Laboratory works 1 -11</i>
<i>To demonstrate awareness of the latest principles and methods of environmental protection</i>	<i>Information search in scientific research</i>	<i>Laboratory works 1 -11</i>
<i>To be able to use up-to-date information resources on ecology, nature management and environmental protection</i>	<i>Methodology of scientific research</i>	<i>Laboratory works 1 -11</i>
<i>To be able to assess landscape and biological diversity and analyze the effects of anthropogenic impact on the environment</i>	<i>Methodology of scientific research</i>	<i>Laboratory works 1 -11</i>
<i>To be able to assess the potential impact of man-made objects and economic activities on the environment</i>	<i>Information search in scientific research</i>	<i>Laboratory works 1 -11</i>
<i>To apply new approaches to develop decision-making strategies in complex unpredictable conditions</i>	<i>Information search in scientific research</i>	<i>Laboratory works 1 -11</i>
<i>To assess environmental risks in the conditions of insufficient information and conflicting requirements</i>	<i>Information search in scientific research Психологія наукової творчості</i>	<i>Laboratory works 1 -11</i>
<i>To choose the optimal management strategy and/or nature management depending on ecological conditions</i>	<i>Methodology of scientific research Psychology of scientific creativity</i>	<i>Laboratory works 1 -11</i>
<i>To critically comprehend theories, principles, methods and concepts from various subject areas to solve practical problems and problems of ecology</i>	<i>Methodology of scientific research</i>	<i>Laboratory works 1 -11</i>
<i>To be able to use modern methods of processing and interpretation of information in innovative activities</i>	<i>Information search in scientific research General information about the concept of science</i>	<i>Laboratory works 1 -11</i>
<i>To be able to independently plan the implementation of an innovative task and formulate conclusions based on its results</i>	<i>Information search in scientific research General information about the concept of science Psychology of scientific creativity</i>	<i>Laboratory works 1 -11</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>Information search in scientific research General information about the concept of science Psychology of scientific creativity</i>	<i>Laboratory works 1 -11</i>

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 workshop	IWS	MCW	
Day/distress/mixed	autumn	10,5/315	18	-	-	126	-	171	1	Exam

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

1. The student's rating from the credit module is calculated from 100 points, of which 52 points are the starting scale.

- performing 11 laboratory works;

- implementation of modular control work (MKR is divided into 2 works lasting 45 minutes).

2. Criteria for scoring.

2.1. Laboratory work:

- impeccable work – 4 points;

- there are certain shortcomings in the preparation and / or performance of work – 3-1 points;

- absence from class without good reason – -1 point.

2.2. Control works are evaluated in 6 points:

- "excellent" – full answer (at least 90% of the required information) – 4 points;

- "good" – a sufficiently complete answer (at least 75% of the required information), or a full answer with minor inaccuracies – 3 points;

- "satisfactory" – incomplete answer (at least 60% of the necessary information) and minor errors – 2-1 points;

- "unsatisfactory" – the answer does not meet the requirements for "satisfactory" – 0 points.

3. The condition of the first certification is to receive at least 8 points. The condition of 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 control work, 6 laboratory work starting rating of at least 26 points.

5. At the exam, students perform written control work. Each task contains two theoretical questions (tasks) and one practical one. The list of questions is given in the Recommendations for the assimilation of the credit module. Each question (task) is evaluated at 16 points according to the following criteria:

- "excellent", full answer, at least 90% of the necessary information (full, unmistakable solution of the problem) – 16-10 points;

- "good", a sufficiently complete answer, at least 75% of the necessary information or minor inaccuracies (complete solution of the problem with minor inaccuracies) – 9-5 points;

- "satisfactory", incomplete answer, at least 60% of the necessary information and some errors (the task is performed with certain shortcomings) – 4-1 points;

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

6. The amount of starting points and points for examination control work is transferred to the examination assessment according to the table:

Points:	Score
Laboratory work + MCW + examination work	
100... 95	Perfectly
94... 85	Very good
84... 75	Well
74... 65	Satisfactory
64... 60	Enough
Less than 60	Disappointing
Unfulfilled laboratory works	Not allowed

4. Additional information on the discipline (educational component)

QUESTIONS FOR MODULAR CONTROL WORK

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.

QUESTIONS FOR THE EXAM

1. To define the concept of genesis of science.
2. Describe the essence and classification of science.
3. Bring with the work and classification of science.
4. Reveal the historical aspect and modern priorities of science.
5. Bring etapa science development.
6. Give the main stages and story of Ukrainian science.
7. Determine the directions of dialnost and the National Academy of Sciences of Ukraine.
8. Bring cadre provision of scientific research.
9. Give the concept of scientific research and their classification.
10. Identify with a general scientific and empirical research methods.
11. Describe with timely scientific priorities of Ukraine.
12. To bring ways and integration and differentiation in science.
13. Describe the organization in structures in scientific research in Ukraine.
14. Lead to the organization sectors of science.
15. To define the concepts of methodology, method, methodology in scientific research.
16. To bring the structure of the methodological apparatus in scientific research.
17. Give a description of the stemmyo d u and relationships in science.
18. Reveal the essence of phenomena with padkoyemnyo art and ethics and in science.
19. To give a determination of the method of scientific research.
20. Describe the method of oppositions in research.
21. To give features of scientific knowledge: essence, objects, subjects.
22. Bring the method of scientific knowledge.
23. Provide with a main conducting scientific research.
24. Determine the main stages of the preparation of the research schedule.
25. Give the main forms of generalization of research results.
26. Give the method of determining the relationship between factors and phenomena.
27. Give forms for the completion and presentation of the results of scientific research.
28. Give a description of the concept of aukova publication.
29. To bring the concept of aukova monograph, scientific article, abstract.
30. Determine the point of practical implementation of the research results.
31. To give the essence of the concept of the effectiveness of scientific research.
32. To give the essence of the concept of "information", its essence, role and typology.
33. Give a description of the effective about art and the results of scientific research and its criteria in.
34. Provide the main components and stages of the economic efficiency of scientific research.
35. Writing on the classification of information support of scientific research.
36. To reveal the concept of information and its use in the research process.
37. Describe metodikin search of primary sources.
38. To bring the stages of scientific personnel.
39. To reveal the concept of blunt education in Ukraine: the scientific degrees of today.

40. Give a description of the soblystvohey training of scientific personnel in Ukraine in the light of joining the Bologna process.

Work program of the discipline (syllabus):

Compiled assoc., Ph.D., Nosachova Y.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)