Syllabus
Course Program

Environmental management

Specialty
E2 – Ecology

Institute
Institute of mechanical engineering and transport

Specialization
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Department
Chemical Engineering and Environment Protection (154)

Educational program
Engineering ecology

Course type
Compulsory, special (professional)

Level of education
Master's level

Form of study
Full-time, part-time, distance learning

Semester
1

Language of instruction
English

Lecturers and course developers

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Doctor of Technical Sciences, Professor, Professor of the Department of Chemical Engineering and Industrial Ecology

Teaching experience – 28 years. Author and co-author of over 220 scientific and methodological publications. Lectures on the following courses: "Modeling and Forecasting of the Environmental State", "Landscape Ecology", "Environmental Management", "Geoinformation Technologies", "Waste Management Systems"

More information about the lecturer on the department website

General information

Summary

The discipline is aimed at mastering the knowledge of the theoretical foundations of managerial, technological, financial and economic measures aimed at reducing the environmental burden on the environment. The course examines the basic principles of the theory of environmental economics and management of environmental and technogenic safety. Attention is focused on acquiring skills in computer processing of environmental monitoring data to obtain mathematical models and hypotheses regarding the cause-and-effect relationships between technogenesis and the state of the environment, which are the basis of balanced management.

Course objectives and goals

Formation of basic knowledge about methods of environmental management, environmental audit, basic laws and their application to solve scientific and technical problems related to achieving the desired, possible and necessary state of the environment as an object of management; minimizing the likelihood of environmental crises and environmental disasters. The objectives of the discipline are to form skills in calculating the eco-efficiency of the production process, eco-balances of material and energy flows and cycles within the framework of the general concept of management; construction and use of models reflecting the entire set of relationships between resources and the results of economic activity.

Format of classes

Lectures, practical classes, consultations. Abstract. Final control – exam.

Competencies

GC-1. Ability to learn and master modern knowledge.
GC-2. Ability to make informed decisions.
GC-3. Ability to generate new ideas (creativity).
GC-7. The ability to motivate people and move towards a common goal.
SC-6. Ability to manage the strategic development of a team in the process of carrying out professional activities in the field of ecology, environmental protection and sustainable use of nature.
SC-7. Ability to organize work related to the assessment of the ecological state, environmental protection and optimization of natural resources, in conditions of incomplete information and conflicting requirements.
SC-10. Ability to assess the level of negative impact of natural and anthropogenic factors of environmental hazards on the environment and humans. SK-11. Ability to integrate modern scientific knowledge to develop and implement effective systems of environmental monitoring and risk management associated with man-made accidents and disasters. SK-12. Ability to use innovative tools and methods to develop and optimize environmentally safe technologies.

Learning outcomes

RE-1. Know and understand fundamental and applied aspects of environmental sciences.
RE-2. Be able to use conceptual ecological patterns in professional activities.
RE-5. Demonstrate the ability to organize collective activities and implement complex environmental projects, taking into account available resources and time constraints.
RE-9. Know the principles of personnel and resource management, basic approaches to decision-making in conditions of incomplete/insufficient information and conflicting requirements.
RE-10. Demonstrate awareness of the latest principles and methods of environmental protection.
RE-13. Be able to assess the potential impact of man-made objects and economic activities on the environment.
RE-14. Apply new approaches to developing a decision-making strategy in complex, unpredictable conditions.
RE-15. Assess environmental risks in the face of insufficient information and conflicting requirements.
RE-16. Choose the optimal management and/or environmental management strategy depending on environmental conditions.
RE-21. Know modern methods and tools for conducting a comprehensive environmental audit and environmental monitoring, apply them to assess the state of the environment and the impact of various factors on it.
RE-22. Possess the skills to develop and implement effective strategies for managing natural resources and preventing negative impacts on the environment, taking into account modern environmental challenges and global trends.
RE-23. Ability to analyze and synthesize information to develop innovative environmental technologies and methods that contribute to reducing environmental burden and increasing the efficiency of environmental management.

Student workload

The total duration of the course is 120 hours (4 ECTS credits): lectures – 32 hours, practical classes – 16 hours, independent work – 72 hours.

Course prerequisites

To successfully complete the course, you must have knowledge and practical skills in disciplines from the first (bachelor's) level of education.

Features of the course, teaching and learning methods, and technologies

Lectures are conducted interactively using multimedia technologies. Practical classes use reproductive and problem-solving teaching methods and focus on solving problems of assessing the state and factor loads based on cognitive modeling of system objects, problems of ecological and economic analysis using cognitive models, and assessing the environmental safety of industrial production.

Program of the course

Academic classes

Lectures

Topics of the lectures	Number of hours
Topic 1. Introduction: Fundamentals of Environmental Management Basic methods and models of management systems for environmental management tasks	2
Topic 2. Methodological foundations of environmental management. Basic terminology. Concepts of management, environmental protection activities, audit, environmental management and audit. Formulation of tasks of ecological and economic analysis.	2
Topic 3. The task of minimizing emissions, reducing environmental pollution. Emission reduction tasks at enterprises. Production quality management.	2
Topic 4. Pigou pollution tax and the condition of market equilibrium under the Pareto optimum condition. Problem statement. Solving the problems of determining the size of environmental fines and the conditions for their introduction.	2
Topic 5. Determining the environmental penalty according to Pareto optimality. Problem statement. Solving the problems of determining the size of environmental fines and the conditions for their introduction.	2
Topic 6. Features of environmental requirements under conditions of long-term equilibrium. Environmental tax on emissions. Problem statement. Determination of environmental requirements within the framework of economic development. Conditions for maintaining ecological and economic balance.	2
Topic 7. Environmental requirements under emissions trading. Emission permit. Problem statement. Models of economic efficiency in the emissions market. General content of the emission permit.	2
Topic 8. Models of the ecological and economic state of production for choosing an effective technology. The concept of environmental technologies. Environmental and economic efficiency of production, ecological and economic balance.	2

Topic 9. Assessment of environmental safety of industrial production. Environmental and economic risk. Risk analysis in the context of ecological production.	2
Topic 10. The task of organizing and placing production facilities taking into account the development of natural and territorial complexes. The concept of natural and territorial complexes. Tasks of nature management and protection of natural ecological systems.	2
Topic 11. Dinkelbach's comprehensive model of optimal resource allocation. Conditions for rational use of resources. Optimal resource provision of production.	2
Topic 12. Optimal solutions to the ecological and economic problem using the Dinkelbach model. Determining the main parameters of the resource efficiency model	2
Topic 13. Major economic sanctions for resource use and emissions. Buying and selling pollution rights. Emissions permit sales market.	2
Topic 14. Cognitive modeling for solving problems of managing weakly structured systems. The concept of a weakly structured system. Cognitive models in ecological and economic analysis.	2
Topic 15. The task of assessing the state and factor loadings based on cognitive modeling of system objects. Construction of cognitive maps. Scenario approach in solving problems of ecological and economic analysis.	2
Topic 16. Examples of ecological and economic analysis tasks using cognitive models. Environmental management in action at the enterprise. Solving environmental management issues at the level of technogenically loaded cities.	2
Total hours	**32**

Workshops

If available

Topics for workshops	Number of hours	Weighting factors *b*
Topic 1. Introduction to "first-best", "second-best" methods. Calculation of production parameters given the existing requirements of ecological balance.	2	0.05
Topic 2. Solving problems to determine the Pigou pollution tax. Basic conditions for establishing a pollution tax. Production parameters for compliance with environmental permits.	4	0.05
Topic 3. Environmental taxes, environmental insurance. Requirements for concluding environmental insurance contracts: possibilities of avoiding significant expenses in situations of environmental disaster, accidents. Solution of the problem of determining the insured amount, insurance premium.	4	0.05
Topic 4. Optimality of production resource provision – calculations using the Dinkelbach complex model. The stage of actual calculation (metrization) of the task of determining the type of cost-saving technology in relation to the material support of the production of a certain type of product.	2	0.05

Topic 5. Construction of diagrams, map layouts. Collection, accumulation, calculation, analysis of ecological and economic monitoring data and their statistical processing. The influence of ecological tools on decision-making in choosing a technology.	2	0.05
Topic 6. Principles of development of natural systems and sustainability of industrial ecological systems (IES). Collection, accumulation, calculation, analysis. Case and them role in solving environmental problems. Evaluation of ecological and economic monitoring data and the results of their processing.	2	0.05
Topic 7. Resource allocation algorithm. Determination of information support for solving the problem of environmental efficiency of production, selection of rational technology.	2	0.1
Topic 8. Building a cognitive model of the territory as a man-made and natural object. Scenario approach for determining conditions for compliance with environmental safety	2	0.6
Total hours	**16**	$\sum_{i=1}^{n} b_i = 1$

Laboratory classes

Laboratory work is not provided within the discipline.

Tests

One final test, which covers the theoretical issues of the course and takes the form of a test survey based on lecture materials.

Topics of test papers	Weighting factors *a*
Test work	1
Total hours	$\sum_{i=1}^{n} a_i = 1$

Independent work

The course involves independent study of theoretical material and preparation of an abstract, which includes a descriptive part - a presentation of the technogenic and natural complex, taking into account the socio-economic structure of a certain territory, and a practical part - making decisions on environmental management based on examples of practical problems based on the use of MIPS analysis or graphic modeling. It is carried out using computer information processing tools and the software application proposed in the abstract.

Study of theoretical material

Topics for self-study	Number of hours
Topic 1. Prevention of negative anthropogenic impact on nature in the process of production, consumption and disposal of manufactured products.	3
Topic 2. Organization of environmentally safe production processes. Ensuring the environmental compatibility of all production.	3

Topic 3. Getting maximum results with minimum effort environmental damage	3
Topic 4. Transforming environmental constraints into new opportunities growth in production activity	3
Topic 5. Product innovation based on demand and creating a "green" image of the enterprise in the eyes of the public	3
Topic 6. Stimulating environmental initiatives that reduce costs or contribute to revenue growth	3
Topic 7. International approach to environmental management. Historical aspects of the development of the concepts of ISO and EMAS.	3
Topic 8. Prospects for the implementation of environmental management in Ukraine: reasons for certification according to the ISO 14000 series of standards by Ukrainian enterprises	3
Topic 9. Mechanisms of legal and economic responsibility of eco-management entities: a complex of mechanisms of environmental responsibility	3
Topic 10. Methodological principles when conducting an environmental audit: "environmental audit criteria".	3
Topic 11. Principles of conducting a state ecological examination. Analytical stage of ecological examination	3
Topic 12. Mechanism for accreditation of bodies offering certification services. International norms and rules in the field of environmental certification	3
Topic 13. Features of environmental licensing: global and domestic experience	3
Topic 14. Corporate environmental management system	3
Total hours	**42**

Topics of individual tasks

Requirements for completing an individual assignment (essay) and its calculation part, examples of implementation are given in detail at the link
https://iiiii-my.sharepoint.com/personal/tatiana_kozulia_khpi_edu_ua/_layouts/15/Doc.aspx?sourcedoc=%7B2825a71c-1130-42a2-bf17-47993d3f402d%7D&action=edit&wd=target%28%D0%9F%D0%A0%D0%90%D0%9A%D0%A2%D0%98%D0%9A%D0%90.o ne%7C36266d8c-35cb-4667-906a-5c2382e065b4%2F%D0%9F%D1%80%D0%B0%D0%BA%D1%82%D0%B8%D1%87%D0%BD%D0%B5%20%D0%B7% D0%B0%D0%B2%D0%B4%D0%B0%D0%BD%D0%BD%D1%8F%7C976c1d5b-28b4-4e5b-aca5-3895181b5341%2F%29&wdorigin=NavigationUrl

Individual assignment topics

Topic 1.* Environmental management research methodology **Theoretical aspects of determining eco-efficiency assessment.** Environmental Performance Assessment (EPA).
Topic 2*. Environmental labeling. Choosing and making environmental decisions General information on the assessment of the environmental situation for the provision of eco-labels
Topic 3*. Environmental management system at the enterprise level. Methods for assessing the environmental sustainability of enterprises.

Indicators or sets of indicators (Individual/Set of Indicators). Material and Energy Flow Analysis (MEFA). MIPS method (material input per unit of service or useful product)	
Total hours	**30**

* – a specific object of research is selected, which is an enterprise/production technology; in accordance with the topic of the individual task as a direction for determining its ecological state and impact on the environment, an assessment of its environmental efficiency is provided.

Non-formal education

Informal education is provided in the form of participation in conferences on course topics and obtaining appropriate certificates, submission of materials for publications in accordance with individual tasks is counted as submission of an essay with a calculated task with a maximum score of 100 points. As confirmation, a certificate of a conference participant and a link to the publication of materials are provided. Passing an online course with obtaining a certificate is counted as completion of practical classes.

Recommended courses, trainings, internships

1. Online course "How to organize environmental management at an enterprise?" https://ukraine-oss.com/yak-organizuvaty-ekologichnyj-menedzhment-na-pidpryyemstvi/ ....
2. Online course "Environmental Management (free online course with diploma)" https://ua.educations.com/institutions/alison-free-online-learning/ekologichnij-menedzhment-bezkoshtovnij-onlajn-kurs-z-diplomom https://r.autocad-specialist.ru/archicad-landscape-free
3. Course on ISO 14001:2015 - Environmental Management Systems (EMS). https://ua.educations.com/institutions/alison-free-online-learning/kurs-z-iso-140012015-sistemi-upravlinnya-navkolishnim-seredovishem-ems

Literature, training materials, and information resources

Basic literature

1. Law of Ukraine "On Environmental Protection" dated 06/25/1991 No. 1264-XII. Update date: 06/07/2020. URL: https://zakon.rada.gov.ua/laws/show/1264-12
2. DSTU ISO 14001:2015 Environmental management systems. Requirements and guidance for application (ISO 14001:2015, IDT). URL: http://online.budstandart.com/ua/catalog/docpage.html?id_doc=64015
3. Bobrovsky A.L. Ecological Management. Kyiv: University Book. 2023. 586 p. URL https://book.sumy.ua/ekologichnij-menedzhment/
4. Luk'yanova O. M. Ecological Management: Lecture Notes. Kharkiv: UkrDUZT, 2022. 66 p. URL: http://lib.kart.edu.ua/bitstream/123456789/9817/1/%D0%9A%D0%BE%D0%BD%D1%81%D0%BF%D0%B5%D0%BA%D1%82%20%D0%BB%D0%B5%D0%BA%D1%86%D1%96%D0%B9.pdf
5. Environmental Management: Environmental Issues, Awareness and Abatement Paperback. 2021. 218. URL : https://www.amazon.in/Environmental-Management-Issues-AwarenessAbatement/dp/9811538158
6. Sharavara V. V. Economics of nature use: a textbook [for students of universities, special 101 Ecology, 103 Earth Sciences] Kamianets-Podilskyi National University named after I. Ogienko. Kamianets-Podilskyi:
Ruta Printing House, 2020. 250 p. URL:
http://elar.kpnu.edu.ua:8081/xmlui/bitstream/handle/123456789/4939/Sharavara-VV-LiubynskyiO.I.-Ekonomika-pryrodokorystuvannia.pdf?sequence=1&isAllowed=y
7. Kozulya T.V. Theory and practice of environmental management. Teaching and methodical manual for practical classes. Kharkiv: NTU "KhPI". 2014. 92 p. URL:
http://library.kpi.kharkov.ua/files/IMG/women/kozulya_spysok.pdf

Additional literature

1. Strategic Environmental Assessment of the Comprehensive Plan. Kyiv, 2022. 108 p. URL: https://decentralization.gov.ua/uploads/library/file/819/SEO_ready.pdf
2. Bauer-Simpson K. What is the Difference Between Environmental Assessment and Environmental Impact Assessment? March 31, 2020. URL : https://www.focusedvision.com.au/what-is-the-difference-between-environmental-assessment-and-environmental-impact-assessment/
3. Management Plan 2024 DG ENVIRONMENT/ URL : https://commission.europa.eu/document/download/27bff4ae-01a7-427d-b1ca-1510b7e92401_en?filename=env_mp_2024.pdf
4. Lunyova O.V. Methodology for choosing environmental protection technologies based on the integral indicator of environmental impact. Ecological Sciences No. 2(25). P.126–132. URL: https://doi.org/10.32846/2306-9716-2019-2-25-20

Information resources

1. Environmental management in Ukraine-2025: what is important to consider? https://ukraine-oss.com/ekologichnyj-menedzhment-v-ukrayini-2025-shho-vazhlyvo-vrahuvaty/
2. Environmental Management Guidelines https://ecolabeling.wordpress.com/ecomanagement_school/ecomanagement_guide/
3. https://textbook.com.ua/ekologiya/1473446089/s-9

Grading system

The final grade for the educational component is determined by the lecturer and is based on topics, types of activities, etc., in accordance with the syllabus. It is an integrated assessment of the results of all types of student learning activities. The final grade should reflect all the grades for the different parts of the educational process, taking into account their weighting coefficients k:

Continuous assessment (during workshops, seminars, laboratory classes) k_1	Control works (if any), k_2	Individual assignment (if any), k_3	Final assessment (for courses with exams), k_4
0,3	0,1	0,6	

The sum of the coefficients must be equal to one: $k_1 + k_2 + k_3 + k_4 = 1$. The weighting coefficients for the final assessment are decided by the course developer..
The final grade is calculated using the following formula:

$$G = C \cdot k_1 + K \cdot k_2 + \mathrm{I} \cdot k_3 + E \cdot k_4$$

where: C – weighted average score for the continuous assessment
I – individual assignment grade
K – weighted average score for the continuous assessment
E – final assessment (exam) grade

$$C = \frac{C_1 \cdot a_1 + C_2 \cdot a_2 + \ldots + C_n \cdot a_n}{\sum_{i=1}^{n} a_i}$$

де: a_i - weighting coefficient for each workshop (seminar) or laboratory class.

$$K = \frac{K_1 \cdot b_1 + K_2 \cdot b_2 + \ldots + K_m \cdot b_m}{\sum_{i=1}^{m} b_i}$$

де: b_i - weighting coefficient for each control work.

The assessments for each component (C, K, I, etc.) are based on a 100-point scale in line with the provisions of the "Criteria and System for Assessing Knowledge and Skills, and Rating of Higher Education Students" of the National Technical University "Kharkiv Polytechnic Institute."

The final grade is finalized as the calculated value of *G*, rounded up to the nearest integer.

Grading scale

Total points	National	ECTS
90–100	Excellent	A
82–89	Good	B
75–81	Good	C
64–74	Satisfactory	D
60–63	Satisfactory	E
35–59	Unsatisfactory (requires additional learning)	FX
1–34	Unsatisfactory (requires repetition of the course)	F

Norms of academic integrity and course policy

Students must adhere to the Code of Ethics of Academic Relations and Integrity of NTU "KhPI": to demonstrate discipline, good manners, kindness, honesty, and responsibility. Conflict situations should be openly discussed in academic groups with a lecturer, and if it is impossible to resolve the conflict, they should be brought to the attention of the Institute's management.
Regulatory and legal documents related to the implementation of the principles of academic integrity at NTU "KhPI" are available on the website: http://blogs.kpi.kharkov.ua/v2/nv/akademichna-dobrochesnist/

Approval

Approved by

30.08.2025 

Head of the department
Oleksii SHESTOPALOV

30.08.2025

Guarantor of the educational program
Eugenia MANOILO