



## Syllabus Course Program



# Fundamentals of Scientific Researches

### Specialty

101 – Ecology

### Educational program

Engineering ecology

### Level of education

Master's level

### Semester

1

### Institute

Scientific and educational institute for Mechanical Engineering and Transport

### Department

Chemical Engineering and Environment Protection (154)

### Course type

General, Mandatory

### Language of instruction

English, Ukrainian

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## Lecturers and course developers



### Alona TULSKA

[alona.tulska@khpi.edu.ua](mailto:alona.tulska@khpi.edu.ua)

Candidate of Technical Sciences, Associated Professor

[General information, amount of publications, main courses, etc](#)



### Musii TSEITLIN

[musii.tseitlin@khpi.edu.ua](mailto:musii.tseitlin@khpi.edu.ua)

Doctor of Technical Sciences, Professor

Experience of teaching work - 32 years. Author and co-author of more than 250 scientific and methodical publications, as well as 20 patents. Delivers lectures on the following courses: "Design of environmental protection complexes using CAD", "Engineering systems of water supply and drainage", "Fundamentals of thermodynamics", "Methods of processing experimental information and research results"

[More about the lecturer on the department's website](#)

## General information

### Summary

The discipline is aimed at forming the second (master's) level of higher education students with the knowledge and skills necessary to solve tasks related to the planning and conducting of scientific research and the implementation of their results.

### Course objectives and goals

To form students' concepts regarding the principles and mechanisms of scientific research, analysis and generalization of scientific literature, providing experiments, handling results using methods of mathematical statistics, summarization

### Format of classes

Lectures, practice classes, calculation tasks, consultations. Final control is an exam.

### Competences

GC-1. The ability to learn and master modern knowledge.

GC-3. The ability to generate new ideas.

GC-6. Competence to search, process, and analyze information from various sources.

SC-1. Awareness of the latest achievements necessary for research and/or innovation in the field of ecology, environmental protection, and sustainable use of natural resources.

SC-4. Ability to apply new approaches to analyzing and predicting complex phenomena, and critically evaluating problems in professional activities.

### Learning outcomes

RE-1. Know and understand the fundamental and applied aspects of environmental sciences.

RE-2. Be able to use conceptual ecological patterns in professional activities.

RE-3. Know the basic concepts of natural science, sustainable development, and scientific methodology at the level of the latest achievements.

RE-6. Know the latest methods and tools of environmental research, including methods and tools of mathematical and geoinformational modeling.

RE-11. Be able to use modern information resources on ecology, nature use, and environmental protection conditions.

RE-17. Critically analyze theories, principles, methods, and concepts from different subject areas to solve practical problems and ecological issues.

RE-18. Be able to use modern methods of information processing and interpretation in innovative activities.

### Student workload

The total volume of the discipline is 90 hours. (3 ECTS credits): lectures – 16 hours, practice classes – 16 hours, self-study – 58 hours.

### Course prerequisites

Possession of competences and learning outcomes provided by the standard of higher education in the specialty 101 "Ecology" of the first bachelor's level, as well as general knowledge of natural sciences

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

Lectures are conducted interactively using multimedia technologies. In practical classes, reproductive and problem-solving learning methods are used and attention is focused on solving real problems in scientific research

## Program of the course

### Topics of the lectures

#### Topic 1. Science and scientific research in the modern world.

Characteristics of the process of scientific knowledge. Subjects and objects of knowledge.

#### Topic 2. The essence of scientific research.

Types of research in science (qualitative and quantitative, fundamental and applied, theoretical and empirical).

#### Topic 3. Methodology of science.

Concept of method, technique, methodology, research procedure. The concept of the method of scientific knowledge. Classification of methods used in scientific research. The role of theoretical research methods in scientific research. Types of theoretical research methods and their characteristics. Concept of model and modeling. Empirical methods of scientific research, their essence and classification.

#### Topic 4. Experiment.

The essence of the experiment. Types of experiment. Experiment planning.

#### Topic 5. Technology of research work.

The main stages of scientific research and the logic of their cognitive search.

#### Topic 6. Planning of scientific research.

The choice of the topic of scientific research, which can be attributed to a certain scientific direction or to a scientific problem. Topics of scientific research: theoretical, practical and mixed. Stages of scientific research work. The concept of planning scientific research. Terminological and categorical research apparatus. Scientific apparatus of research. Plan of master's graduation (diploma) or course work.

#### Topic 7. Work with scientific information.

Informational approach in the methodology of cognition. Types and requirements for scientific publications: abstract, dissertations, preprints, collection of scientific works, materials of a scientific conference, theses of reports of a scientific conference, popular scientific publication. Scientific databases, their varieties and features

#### Topic 8. Writing and design of scientific works of students of higher education.

Systematization of research results. Presentation of conclusions and recommendations in the form of methodological recommendations, a scientific article, theses of a report, a report of a course, final master's thesis. Scientific Article.

### Topics of the workshops

#### Topic 1. Work with scientific information

#### Topic 2. Basic methods of scientific research

#### Topic 3. Planning of scientific research

#### Topic 4. Peculiarities of preparation, design and defense of scientific works of higher education applicants

### Topics of the laboratory classes

Laboratory classes are not considered

### Self-study

The course involves the completion of an individual task in the form of a calculation work on the topic: "Planning of scientific research" with a presentation.

## Course materials and recommended reading

1. Hanganu-Bresch C., Zerbe M.J., Cutrufello G., Maci S.M. The Routledge Handbook Of Scientific Communication New York: Routledge, 2022. – 445 p.
2. Bownes J. The Science Student's Guide to Dissertations and Research Projects London: Bloomsbury Academic, 2023. – 177 p.
3. Hastings Janna. AI for Scientific Discovery CRC Press, 2023. – 120 p. – (AI for Everything). – ISBN: 978-1-003-22664-2.

## Assessment and grading

### Criteria for assessment of student performance, and the final score structure

100% of the final grade consists of the results of the assessment in the form of an exam (40%) and the current assessment (60%). Exam: written task and oral answer. Current assessment: calculation task 20%, two current test papers - 20% each

### 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

The student 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

2023/08/31



Head of the department  
Oleksii SHESTOPALOV

2023/08/31



Guarantor of the educational  
program  
Musii TSEITLIN