Syllabus
Course Program

Fundamentals of Scientific Research

Specialty
113 – Applied Mathematics

Institute
Institute of Computer Modeling, Applied Physics and Mathematics

Educational program
Computer and Mathematical Modeling

Department
Mathematical Modeling and Intelligent Computing in Engineering (161)

Level of education
Master's level (1 year 4 months)

Course type
Special (professional), Mandatory

Semester
1

Language of instruction
English

Lecturers and course developers

Gennadiy Lvov (responsible lecturer)

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More about the lecturer on the department's website

Vitalii Ovcharenko (assistant)

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PhD, associate professor of the department of mathematical modeling and intelligent computing in engineering

Author and co-author of more than 30 scientific and methodical publications and patents.

More about the lecturer on the department's website

General information

Summary

The educational discipline "Fundamentals of scientific research" belongs to the normative, aimed at deepening the students' knowledge of the specifics of scientific research, studying the terminology and methodology of modern science, applying the acquired knowledge in practice in educational and research processes. The discipline focuses on the choice of methods and tools of scientific research, compliance with the principles of academic integrity

Course objectives and goals

The purpose of studying the discipline is to get acquainted with the theoretical foundations of scientific research activities, providing methodical recommendations regarding the implementation of specific types of scientific, research and student works.

Format of classes

Practical classes, consultations, self-study. Final control in the form of a credit.

Competencies

GC1. Ability to generate new ideas (creativity) and non- standard approaches to their implementation.
GC3. Ability to master modern knowledge, formulate and solve problems.
GC4. Ability to act socially, responsibly and consciously.
GC5. Ability to conduct professional activities, in particular in the international environment.
GC6. Ability to work in a team and lead it.
GC7. Ability to think abstractly, analyse and synthesise.
PC12. Ability to identify the essence of scientific and technical problems in professional activities, to apply appropriate mathematical models for the study of mechanical objects and processes.

Learning outcomes

LO2. Collect, systematize and analyse scientific and technical information on professional activities.
LO11. Possess skills of abstract thinking, analysis and synthesis.
LO12. To be able to work in a team, develop and manage research, applied and IT projects, potentially in an international environment.
LO14. To have the knowledge to mathematically formalise the formulation of scientific and practical problems, to choose a mathematical analytical or numerical method of its solution, which ensures the required accuracy and reliability of the result.

Student workload

The total volume of the course is 90 hours (3 ECTS credits): practical classes – 32 hours, self-study - 58 hours.

Course prerequisites

To successfully complete the course, students must have knowledge and skills in the following disciplines: "Philosophy".

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

Practical classes use a project approach to learning, game methods, and focus on the application of information technologies in scientific research. Study materials are available to students via OneDrive.

Program of the course

Topics of the lectures

Lectures are not provided within the discipline.

Topics of the workshops

Topic 1. Methodology and methods of scientific research.
Concept of methodology and methods of scientific research. Idealization, formalization, hypothesis, deduction, induction, hypothetical method. Basics of empirical research methodology.
Topic 2. Technology of scientific research.
Relevance, significance and practical value of scientific results. The novelty of scientific research. Review of the literature on the research topic. An experiment in scientific research.

Topic 3. Argumentation as a component of science
Argument with reference to authority. Reasoning about reasons. Deductive reasoning. Scientific dilemmas.
Topic 4. Scientific publications.
Scientific article and its structural elements: introduction, analysis of recent research and publications, formulation of the purpose of the article, presentation of the content of own research, conclusion, bibliographic list, annotations.
Topic 5. Basics of citations.
Qualitative and quantitative characteristics of bibliographic references. General rules for creating bibliographic references.
Topic 6. Academic integrity in scientific research.
The essence of the concept of "academic integrity". Legislative basis of academic integrity. Individual cases of self-plagiarism in scientific activity.
Topic 7. Information search in the process of scientific work.
The essence and types of scientific and technical information. Methods of searching and collecting scientific information. Critical analysis and interpretation of scientific information.

Topics of the laboratory classes

Laboratory classes are not provided within the discipline.

Self-study

The course involves the preparation of a literature review/analysis of the state of problems on a topic related to the topic of the master's thesis. The result is presented in the form of a report with a presentation. Additional materials (textbooks, articles) are also recommended for students to self-study and analyze.

Course materials and recommended reading

1 Kumar, Ranjit. Research Methodology: A Step-by-Step Guide for Beginners. Los Angeles: SAGE Publications Ltd, 2014.
2 Booth, Wayne C., Gregory G. Colomb, and Joseph M. Williams. The Craft of Research. Chicago: University of Chicago Press, 2008.
3 Creswell, John W., and J. David Creswell. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches. Thousand Oaks, CA: SAGE Publications, 2017
4 Bausell, R. B. Conducting meaningful experiments. Thousand Oaks, CA: SAGE Publications, 1994

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 credit (40%) and current assessment (60%).
Credit: written assignment and oral report.
Current assessment: a report on a literature review/analysis of the state of problems on a topic related to the topic of the master's thesis (60% 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	Date August 30, 2023	Head of the department Oleksii VODKA
	Date August 30, 2023	Guarantor of the educational and professional program (1 year 4 months) Oleksiy LARIN