



Syllabus Course Program



Fundamentals of Scientific Research

Specialty

113 Applied mathematics

Educational program

Intelligent Data Analysis

Level of education

Master's level

Semester

2

Institute

Educational and Scientific Institute of Computer Science and Information Technology

Department

Computer Mathematics and Data Analysis

Course type

Special (professional), Mandatory

Language of instruction

English

Lecturers and course developers



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Doctor of Science in Physics and Mathematics, professor, professor

Work experience – 22 years. Author of more than 160 scientific and educational works. Lecturer in the disciplines: "Higher Mathematics", "Stochastic Processes and Stochastic Systems", "Social Network Models", "Data Models and Visualization".

Google Scholar:

<https://scholar.google.com/citations?hl=en&user=UE0HQSUAAAJ>

ORCID: <https://orcid.org/0000-0002-0189-8655>

Scopus: <https://www.scopus.com/authid/detail.uri?authorId=9270293800>

Web of Science: <https://www.webofscience.com/wos/author/record/AAA-7891-2019>.

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

General information

Summary

The discipline is aimed at the formation of students' practical skills and abilities in the research process; formation of professional abilities aimed at solving scientific problems.

Course objectives and goals

Acquaintance of students with modern concepts and foundations of scientific knowledge and with the methodology of scientific research; formation of a holistic view of the research process; mastering the skills of forming and using a conscious position of scientific research; improvement of skills in the search, selection, and processing of scientific information, in the accurate formulation of the purpose, objectives and conclusions of the study.

Format of classes

Lectures, practical classes, calculation tasks, consultations. Final control – test.

Competencies

GC2: Ability to preserve and enhance moral, cultural, scientific values and achievements of society based on understanding the history and patterns of development of the subject area, its place in the general system of knowledge about nature and society and in the development of society, technology, and technologies
GC3: Ability for continuous learning, acquiring new knowledge and skills, including in areas other than professional ones.

GC6: Ability to critically evaluate and rethink accumulated experience (own and others'), analyze one's professional and social activities.

GC7: Ability to work with information, find and use information from various sources necessary for solving professional tasks.

SC7: Ability to search, study, and analyze scientific and technical information, domestic and foreign experience related to the application of mathematical methods for the study of processes and systems.

Learning outcomes

LO10: Ability to collect, process, analyze, and systematize scientific and technical information, avoiding plagiarism, form judgments, develop presentations, and publications.

Student workload

The total volume of the course is 150 hours (5 ECTS credits): lectures - 32 hours, workshops - 32 hours, self-study - 86 hours.

Course prerequisites

"Mathematical Analysis", "Probability Theory", "Mathematical Statistics", "Programming"

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

Lectures are conducted interactively using multimedia technologies. Workshops are carried out using free software - Python libraries Pandas, SciPy, NumPy. Educational materials are available to students in the Microsoft 365 environment through OneDrive and OneNote Class Notebook and Teams

Program of the course

Topics of the lectures

Topic 1. General information about science and scientific research

Lecture 1. The role and tasks of science in the development of society

Lecture 2. Theoretical foundations of scientific research

Lecture 3. Fundamentals of Research Methodology

Lecture 4. Research Methods

Lecture 5. Organization of scientific research.

Lecture 6. Main types of scientific papers

Lecture 7. Content and stages of research work

Lecture 8. Hypotheses in scientific research

Topic 2. Information support of scientific research

Lecture 9. Information support of scientific research

Lecture 10. The Role and Functions of Information

Lecture 11. Organization of scientific information retrieval

Lecture 12. Procedure for processing and presenting information in research.

Topic 3. Design of scientific work

Lecture 13. Structure and design of scientific papers

Lecture 14. Types, features of presentation and forms of research results

Lecture 15. Implementation of the results of scientific research

Lecture 16. Preparation for the defense and defense of the qualifying scientific work

Topics of the workshops

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Topic 1. General information about science and scientific research

Workshop 1. History of the development of science. Formation of research activities in Ukraine and in the world.

Workshop 2. Concepts, functions, and meanings of science. The structure of science as a system of knowledge. Classification of Sciences.

Workshop 3. Methodology of scientific research. General Methods of Scientific Research

Workshop 4. The essence, purpose, functions of a scientific experiment. Scientific Forecasting as a Research Method: Content, Main Types and Technologies of Implementation.

Workshop 5. Characteristics of scientific structures and institutions, their tasks and features

Workshop 6. Scientific article. Abstracts of the scientific report. Review. Qualification scientific work (master's final qualification work, dissertation).

Workshop 7. Scientific problem and justification of the research topic. Criteria for choosing the topic of scientific research, the procedure for its concretization and approval

Workshop 8. Test No1.

Topic 2. Information support of scientific research

Workshop 9. Classification of information support: information, message, information carrier; Types of professional information communication

Workshop 10. Selection of the object of inspection and determination of the system of indicators to be collected in the process of observation

Workshop 11. Universal Decimal Classification (UDC) and Library Classification (LBC) system.

Workshop 12. Carrying out analytical work in the research process

Topic 3. Design of scientific work

Workshop 13. Typical requirements for the structure and design of the introduction, the main and final parts of the qualifying scientific work.

Workshop 14. Methods of presentation of scientific research materials. Approbation and publication of the results of scientific research.

Workshop 15. Implementation of the results of completed scientific research. Effectiveness of research results, their criteria and evaluation.

Workshop 16. Test No2.

Topics of the laboratory classes

Not provided for in the curriculum.

Self-study

Topic 1. General information about science and scientific research

Mathematical Methods in Scientific Research. Systematic approach in scientific research. Fundamental and applied research. The main stages of scientific research and their characteristics. Research Methodology.

Topic 2. Information support of scientific research

Incorrect use of scientific literary sources. Signs of plagiarism. Legislative, regulatory and reference, contractual, organizational and managerial, factual support. Structure and organization of a bibliography on mathematical knowledge. Organization of the search for scientific information and its processing. Automated information retrieval systems. Features of searching for information on the Internet.

Topic 3. Design of scientific work

Systematization of the results of scientific research. Forms of presentation of digital and illustrative material. Bibliographic description of the sources used in the scientific research. Language and style of scientific work. Implementation of results and effectiveness of scientific research

Course materials and recommended reading

1. Barnard, A. (2000). History and Theory in Anthropology. Cambridge: Cambridge University Press

(<https://fpa2014.files.wordpress.com/2014/07/barnard-historytheoryanthropology.pdf>)

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National Technical University
"Kharkiv Polytechnic Institute"

2. Nagel, E. (1979). *The Structure of Science: Problems in the Logic of Scientific Explanations*. Delhi: Macmillan India Ltd (original Routledge and Kegan Paul) (<https://www.unicamp.br/~chibeni/textosdidaticos/nagel-structure-preface.pdf>)
3. Anyon, J. (2008) *Theory and educational research: Toward critical social explanation*. London: Routledge.
4. Fleith, D., Bruno Faria, M. and Alencar, E. (2014) *Theory and measurement of creativity*. Waco, Texas: Prufrock Press. (https://www.worldscientific.com/doi/pdf/10.1142/9789813229594_0001)
5. CHAPTER 1 | Introduction to Research 13 Research Methods Downloaded from www.worldscientific.com by 77.122.3.69 on 01/08/24. Re-use and distribution is strictly not permitted, except for Open Access articles.
6. *Research Methods: A Practical Guide for Students and Researchers* Mill, J. (1884) *A system of logic*. London: Longman.
7. Popper, K. (2002) *Conjectures and refutations*. London: Routledge

Assessment and grading

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

Description of the final score structure, course requirements, and necessary steps to earn points, especially paying attention to self-study and individual assignments.

Grading scale

<i>Total points</i>	<i>National</i>	<i>ECTS</i>
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, signature

31.08.2023

Head of the department

Olena AKHIEZER

Date, signature

31.08.2023

Guarantor of the educational program

Leonid LYUBCHYK