



## Syllabus Course Program



# Basics of the scientific research

**Specialty**

131 – Applied Mechanics

**Educational program**

Applied Mechanics

**Level of education**

Master's level

**Semester**

2

**Institute**

Institute of Education and Science in Mechanical Engineering and Transport

**Department**

Hydraulic machines named after G. F. Proskura (150)

**Course type**

Special (professional), Mandatory

**Language of instruction**

English, Ukrainian

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## Lecturers and course developers

**Kseniia Riezva**

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Candidate of Technical Sciences, Associate Professor of the Department of Hydraulic Machines of NTU "KhPI"

Work experience is more than 10 years.

Author and co-author of more than 60 scientific and educational works.

Courses: "Technical equipment and technology of well repair", "Introduction to the specialty. Introductory practice", "Hydrogasdynamics", "Hydraulics", "Basics of scientific research", "Fountain and gas safety in the oil and gas industry", "Machines and equipment for wells drilling, equipment for oil and gas production"

## General information

### Summary

The course deals with general knowledge of conducting scientific research at various levels. During its study, students learn methods of scientific research, how they are used to obtain the necessary results. They acquire theoretical foundations for conducting scientific research, implementing and evaluating the effectiveness of scientific research. They study the stages and features of conducting scientific works. Get acquainted with the latest technologies in scientific research.

### Course objectives and goals

To learn how to correctly choose a research object and determine research methods for a specific task before the research subject. Deepen knowledge to determine the parts of scientific research and methods that are appropriate to apply for a specific task. To form students' skills to process the obtained results and use them in scientific activities.

### Format of classes

Lectures, practical classes, consultations, self-study. Final control in the form of an exam.

## Competencies

GC1 Ability to identify, set and solve problems  
GC 2 Ability to make well-founded decisions  
GC 3 Skills to use information and communication technologies  
GC 4 Ability to generate new ideas (creativity)  
GC 5 Ability to develop and manage projects  
GC 8 Ability to learn and acquire modern knowledge

## Learning outcomes

PLA 5 Show the ability to independently solve tasks of an innovative nature (qualification work, course task), the ability to argue and defend the obtained results and decisions, in particular publicly  
PLA 11 Demonstrate knowledge and understanding of the basics of organizing the research (scientific) process  
PLA 12 Demonstrate knowledge, understanding and practical application of experimental theory, methods of planning experiments, assessing the reliability of experimental results, methods of analyzing experimental data and building mathematical models based on them, in particular, the use of the latest methods based on the use of modern information technologies

## Student workload

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

## Course prerequisites

To successfully complete the course, you must have knowledge and practical skills in the following disciplines: "Information technologies and programming", "Philosophy", "Modern technologies in applied mechanics", "Intellectual property", "Innovative entrepreneurship and startup project management".

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

Lectures are delivered using multimedia technologies. Practical classes use a project-based approach to learning, game methods, and focus on the use of information technology in the scientific researches. Educational materials are available to students through OneDrive, Whiteboards, on the educational platform of NTU "KhPI" <https://dlc.kpi.kharkov.ua/course/view.php?id=1798>

## Program of the course

### Topics of the lectures

#### Topic 1. General information about science.

Tasks and goals of science. Classification of sciences. Stages of formation of science. Development of science. Tools of science.

#### Topic 2. Scientific research.

The concept of research. Classification of scientific research. Levels of scientific research. Stages of scientific research. Selection a direction of scientific research.

#### Topic 3. Methodological foundations of scientific research.

S Methodological foundations of scientific knowledge. Methods of theoretical and practical research. Elements of theory and methodology of scientific and technical activity.

#### Topic 4. Basics of scientific research organization.

Organization of work in a scientific team. Designing the research results. Analysis and processing of scientific research results.

#### Topic 5. Application of the latest technologies in scientific research.

Modeling in scientific and technical activities. Analog similarity and modeling. The use of computers in conducting scientific research. Experimental studies.

## Topics of the workshops

- Topic 1. Information base of scientific research.
- Topic 2. Organization of scientific research.
- Topic 3. Planning the experiment.
- Topic 4. Analysis of the experiment results.
- Topic 5. Processing of scientific research results.

## Topics of the laboratory classes

The curriculum doesn't include laboratory classes.

## Self-study

The course involves completing an individual task. The results are presented in a written report (PowerPoint presentation).

Students are also recommended additional materials (videos, literature, articles) for self-study and analysis.

## Course materials and recommended reading

1. Farrow, R., Iniesto, F., Weller, M. & Pitt, R. (2020). The GO-GN Research Methods Handbook. Open Education Research Hub. The Open University, UK. CC-BY 4.0. [https://go-gn.net/gogn\\_outputs/research-methods-handbook/](https://go-gn.net/gogn_outputs/research-methods-handbook/)
2. Handbook of Research on Science Education, Volume II (1st ed.). Taylor and Francis. Retrieved from <https://www.perlego.com/book/1625249/handbook-of-research-on-science-education-volume-ii-pdf> (Original work published 2014)
3. Kazdin, A. E. (2016). Single-case experimental research designs.
4. Stuart MacDonald & Nicola Headlam. Research Methods Handbook Introductory guide to research methods for social research.
5. <https://bookdown.org/pkaldunn/Book/>
6. Chang, M. (2016). Principles of Scientific Methods (1st ed.). CRC Press. Retrieved from <https://www.perlego.com/book/1598939/principles-of-scientific-methods-pdf> (Original work published 2016)
7. Fundamentals of Scientific Writing: educational method. manual / A. O. Borisova [etc.]. - Kh.: KhDUHT, 2018. - 128 p.
8. [chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://uomustansiriyah.edu.iq/media/lectures/6/6\\_2023\\_12\\_30!09\\_47\\_05\\_AM.pdf](chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://uomustansiriyah.edu.iq/media/lectures/6/6_2023_12_30!09_47_05_AM.pdf)
9. [chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.emotionalcompetency.com/sci/sm\\_all.pdf](chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.emotionalcompetency.com/sci/sm_all.pdf)

## Assessment and grading

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

Description of the final score structure:  
Report/presentation - 40 points.  
Test - 60 points.

### 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, signature

**Head of the department**  
Andrii ROGOVYI

Date, signature

**Guarantor of the educational program**  
Volodymyr RUBASHKA