



## Syllabus of the educational component

Program of educational discipline

### Basics of the scientific research

**Specialty**

131 – Applied mechanics

**Educational program**

Applied mechanics.

**Level of education**

Master's degree

**Institute**

NNI of Mechanical Engineering and Transport

**Department**

Foundry production (142)

**Course type**

Special (professional), Mandatory

**Semester**

2

**Language of instruction**

Ukrainian, English

### Lecturers and course developers

**Olena Volodymyrivna Masalitina**

[Olena.Masalitina@khp.edu.ua](mailto:Olena.Masalitina@khp.edu.ua)

Senior lecturer of the foundry department of NTU "KhPI"

Work experience - 5 years. Author and co-author of 2 scientific and methodical publications. Courses: "Fundamentals of scientific research".

[Learn more about the teacher on the department's website](#)

### General information

**Summary**

The course " Basics of the scientific research " develops knowledge about the main stages of scientific research work, the structure of the organization of scientific research, the main methodological principles of terminology, understanding the laws, regularities and principles of scientific research, the main stages of scientific research work of students in higher educational institutions, types of information support research work and search methodology.

**Course objectives and goals**

The purpose of studying the discipline is the formation of students' skills in setting scientific problems and solving them at the theoretical and empirical levels. The subject of study in the discipline is methodology and principles of scientific research organization. General characteristics of scientific research. Theoretical and experimental studies. Modeling, forecasting and design of the results of scientific research.

**Format of classes**

Lectures, practical classes, independent work, consultations. Individual calculation task task. Final control - exam.

## Competencies

GC8. Ability to learn and master modern knowledge.

FC3. Application of appropriate methods and resources of modern engineering based on information technologies to solve a wide range of engineering problems using the latest approaches, forecasting methods with awareness of the invariance of solutions.

FC5. The ability to set a problem and determine ways to solve a problem by means of applied mechanics and related subject areas, knowledge of methods of finding the optimal solution under conditions of incomplete information and conflicting requirements

FC7. Ability to describe, classify and model a wide range of technical objects and processes, based on deep knowledge and understanding of mechanical theories and practices, as well as basic knowledge of related sciences.

FC10. The ability to clearly and unambiguously convey one's own conclusions, knowledge and explanations to specialists and non-specialists, in particular, in the process of teaching. Ability to understand the work of others, give and receive clear instructions.

## Learning outcomes

LR1. Apply specialized conceptual knowledge of the latest methods and techniques of design, analysis and research of structures, machines and/or processes in the field of mechanical engineering and related fields of knowledge.

LR 3. Apply automation systems for research, design and construction work, technological preparation and engineering analysis in mechanical engineering.

LR 4 Use modern methods of optimizing the parameters of technical systems by means of system analysis, mathematical and computer modeling, in particular under conditions of incomplete and contradictory information

LR 6 Develop, implement and evaluate innovative projects taking into account engineering, legal, environmental, economic and social aspects.

LR 11 Develop management and/or technological solutions under uncertain conditions and requirements, evaluate and compare alternatives, analyze risks, predict possible consequences.

LR 17. Demonstrate knowledge of the organization, functioning, technical and software support of information and measurement computerized systems in scientific research of mechanical systems and processes.

## Student workload

The total volume of the discipline is 90 hours. (3 ECTS credits): lectures – 16 hours, practical classes – 16 hours, independent work – 58 hours.

## Course prerequisites

To successfully complete the course, you must have knowledge and practical skills from the following disciplines: "Modern technologies in applied mechanics", "Automation of foundry production", "Resource-saving technologies and melting of alloys with special properties".

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

Lectures are conducted interactively using multimedia technologies. On practical ones classes use a project approach to learning, game methods, focus on application of information technologies. Study materials are available to students through OneNote Class Notebook.

## Program of the course

### Topics of lectures

**Topic 1. Science and its role in the development of society. NIRS is an important stage of training. The purpose of the course.**

- Topic 2. Scientific and practical problems of foundry production
- Topic 3. Basic methods of conducting scientific research
- Topic 4. Stages of scientific and technical research
- Topic 5. Mathematical research methods
- Topic 6. Stage of experimental data processing. Construction of empirical dependencies.

### **Topics of the workshops**

- Topic 1. Sciences and their varieties. Scientific research and its levels. Fundamentals of scientific research methodology. Management of scientific research.
- Topic 2. The problem as a starting point of research. Scientific and practical problems of foundry production.
- Topic 3. The method as a starting point and condition of scientific research. The main types of methods. Comparison and measurement. Induction and deduction. Analysis and synthesis. Scientific hypothesis. Abstraction and generalization. Modeling. System approach and system analysis.
- Topic 4. Goals of scientific and technical research. NTD classification. Stages of NTD, their general characteristics.
- Topic 5. The theory of similarity is the basis of mathematical research methods. Types of mathematical methods. Experiment planning.
- Topic 6. Goals and general characteristics of the stage. The method of least squares. Optimum search. Error accounting. Construction of empirical dependencies.

### **Topics of the laboratory classes**

Laboratory work within the discipline is not provided.

### **Self-study**

The program of the course " Basics of the scientific research " provides for the performance of an individual task, which involves the performance of an information search on the topic of research. In the process of performing this task, students learn to work with information sources, acquire the ability to search, process and analyze information from various sources and develop research methods. Students are also recommended additional materials for independent study and analysis.

## **Course materials and recommended reading**

### **Basic literature**

1. V.I. Romanchikov. Basics of scientific research: teaching. guide Kyiv: Center for Educational Literature, 2007
2. Kolesnikov O.V. Basics of scientific research: teaching. village - 2nd ed., ed. and additional - Kyiv: Center for summer education, 2011.
3. Yu.I. Palekha, N.O. Lemish Basics of research work: teacher. Guide Kyiv: Lira-K, 2013.
4. Konversky A.E. Basics of methodology and organization of scientific research: teaching. manual - Kyiv: Center for summer education, 2010.
5. Grabchenko A.I., Fedorovych V.O., Gerashchenko Y.M. Methods of scientific research: Teaching assistant NTU "KhPI", 2009.
6. V.M. Sheiko, N.M. Kushnarenko Organization and methodology of scientific research activity: a textbook. - 6th ed., revised. and additional Kyiv: Znannia, 2008.

### **Additional literature**

1. Povorozniuk, A.I. , Panchenko, V.I. Filatova G.E., Kuchuk G.A. Methodology and organization of scientific research: teaching. manual - Kharkiv: NTU "KhPI", 2016.
2. Tsekhmistrova G.S. Basics of scientific research: teaching. village Kyiv: "Slovo" Publishing House, 2004. - 240 p.

## Assessment and grading

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

100% of the final grade consists of assessment results in the form of credit (40%) and current assessment (60%).

*Test:* written task (2 questions from theories) and an oral report.

*Current assessment:* 2 modular control and calculation task (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": show discipline, education, benevolence, honesty, responsibility. Conflict situations should be openly discussed in study groups with the teacher, and if it is impossible to resolve the conflict, it should be brought to the attention of the employees of the institute's directorate.

Regulatory and legal support for the implementation of the principles of academic integrity of NTU "KhPI" is posted on the website: <http://blogs.kpi.kharkov.ua/v2/nv/akademichna-dobrochesnist/>

## Approval

Approved by

22.08.2023

Date, signature

Head of the department  
Oleg AKIMOV

22.08.2023

Date, signature

Guarantor of the educational  
program

Oleksandr SHELKOVY