



SCIENTIFIC WORK ON THE TOPIC OF THE MASTER'S DISSERTATION-1. BASICS OF THE SCIENTIFIC RESEARCH

Work program of the educational component (Syllabus)

Details of the academic discipline

Level of higher education	<i>Second (master's)</i>
Branch of knowledge	<i>13 Mechanical engineering</i>
Specialty	<i>133 Industrial engineering</i>
Educational program	<i>Engineering and computer-integrated design technologies of innovative industry equipment</i>
Discipline status	<i>Normative</i>
Form of education	<i>daytime</i>
Year of training, semester	<i>First year, fall semester</i>
Scope of the discipline	<i>2 ECTS credits</i>
Semester control/ control measures	<i>test</i>
Lessons schedule	<i>1.5 hours per week (0.5 hours of lectures, 1 hour of practice)</i>
Language of teaching	<i>Ukrainian</i>
Information about head of the course / teachers	Lecturer: <i>Ph.D., Serhiy Valeriyovych Gulienko, sergiiqulienko@gmail.com, +38504488173</i> Practical / Seminar: <i>Ph.D., Serhiy Valeriyovych Gulienko, sergiiqulienko@gmail.com, +38504488173</i> Laboratory: not provided for in the curriculum
Placement of the course	https://classroom.google.com/c/MTQ0ODcxMDQ2NzY5?cjc=y6reglw

Program of educational discipline

1. Description of the educational discipline, its purpose, subject of study and learning outcomes

The high level of technological development and the modern quality of life are largely due to the development of science and discoveries, particularly in the natural and technical sciences. On the other hand, scientific and technological progress raises new challenges and sets new problems for society, the solution of which is not possible without the use of innovative technologies.

In such conditions, the decisive role belongs to the quality of training of scientific and engineering personnel who are able to make timely and well-founded technical decisions. In such conditions, it is a disadvantage for modern engineers to be well informed about the laws of scientific development and to know the methods of conducting scientific research, therefore, in the master's training program in the specialty 133 "Field of mechanical engineering", specialization "Engineering and computer-integrated technologies for the design of innovative industrial equipment", including the course "Scientific work on the topic of the master's thesis-1. Basics of the scientific research".

The purpose of the educational component is the formation of the following competencies in students:

- ZK 1 Ability to use information and communication technologies;
- ZK 2 Ability to learn and master modern knowledge;
- ZK 3 Ability to search, process and analyze information from various sources;
- ZK 4 Ability to be critical and self-critical;
- ZK 5 Ability to adapt and act in a new situation;
- ZK 6 Ability to generate new ideas (creativity);
- ZK 7 Ability to identify, pose and solve problems;
- ZK 8 Ability to make informed decisions;
- SK 1 The ability to create, improve and apply quantitative mathematical, scientific and technical methods and computer software tools, to apply a systematic approach to solving engineering problems of industrial engineering, in particular, in conditions of technical uncertainty;
- SK 2 Critical understanding of advanced scientific facts, concepts, theories, principles for the field of mechanical engineering and the ability to apply them to solve complex problems of mechanical engineering and sustainable development;
- SK 3 Ability to create new equipment and technologies in the field of mechanical engineering;
- SK 4 Awareness of promising tasks of modern production, aimed at meeting the needs of consumers, mastering the trends of innovative development of industry technologies;
- SK 6 Ability to scientific and pedagogical activity in institutions of higher and professional pre-higher education;
- SK 7 Ability to perform scientific and practical and applied research in the engineering industry;
- SC 8 Ability to create intellectual property objects and protect them
- SK 9 Ability to develop equipment taking into account the problems of sustainable development;
- SK 10 Ability to search, analyze scientific and technical information and professional communication in a foreign language;
- SK 11 Ability to analyze and develop technologies for automation of technological processes;
- SK 12 Ability to search for optimal solutions when solving problems of scientific research, design, maintenance and modernization of equipment using computer technologies, CAD systems and other application programs;
- SK 13 Ability to perform mathematical modeling when solving problems of scientific research, design, maintenance and modernization of equipment;
- SK 14 Ability to carry out innovative, design, project and operational activities in the field of mechanical engineering;
- SK 15 Ability to engineer innovative technological processes and possession of modernization, development and ensuring its operability;
- SK 16 Ability to use computer-integrated technologies of industrial equipment design;
- SK 17 The ability to develop and implement plans and projects in the field of mechanical engineering and related activities, to carry out relevant business activities.

According to the educational program, after studying the educational component "Scientific work on the topic of the master's thesis-1. Fundamentals of Scientific Research" students must demonstrate the following learning outcomes:

- RN 2 Knowledge and understanding of mechanics and mechanical engineering and their development prospects;
- RN 3 To know and understand the processes of industrial mechanical engineering, to have skills in their practical use;
- RN 4 Carry out engineering calculations to solve complex tasks and practical problems in industrial mechanical engineering;
- RN 5 Analyze engineering objects, processes and methods;
- RN 7 Prepare production and operate equipment and products of industrial engineering during the life cycle;

- RN 14 Relying on the methods of mathematical modeling and using computer technologies, CAD systems and other application programs to solve the problems of scientific research, design, operation, and modernization of industrial engineering equipment;
- PH 15 Using the fundamental laws of conservation and transfer, select/develop/analyze/implement mathematical models and regulations of processes occurring in the working space and/or in the construction of technological equipment, taking into account the initial and boundary conditions, in software or in environments

2. Pre-requisites and post-requisites of the discipline (place in the structural and logical scheme of training according to the relevant educational program)

The educational component "Scientific work on the topic of a master's thesis" is experienced by academic disciplines of the second (master's) level of higher education, such as: "Engineering of innovative technologies and equipment", "Constructive design of equipment", "Intellectual property and patent science", "Basics of engineering and technology of sustainable development", "Automation of production processes", "Practical course of foreign language business communication". The educational component "Scientific work on the topic of a master's thesis" provides educational components such as "Practice".

3. Content of the academic discipline

Topic 1. Concept of science and basic definitions.

Topic 2. The history of the development of science

Topic 3. Scientific terminology. Forms of scientific knowledge

Topic 4. Methodology of scientific research

Topic 5. General principles of scientific research

4. Educational materials and resources

Basic literature:

1. Scientific work on the topic of the master's thesis - 1. Basics of scientific research. Synopsis of lectures of the credit module [Electronic resource]: teacher. manual for students specialty 133 "Industry of mechanical engineering", specialization "Engineering, computer modeling and equipment design of chemical and oil refining industries" / KPI named after Igor Sikorskyj; comp.: S.V. Gulienko., S.S. Heyday - Electronic text data (1 file: 4.37 MB). – Kyiv: KPI named after Igor Sikorskyj, 2019. – 128 p.
2. How to prepare and defend a dissertation for obtaining a scientific degree. Methodical advice. 5th edition, corrected and supplemented / Author-editor L.A. Ponomarenko, doctor of technical sciences, professor. - K.: "Toloka" Publishing House, 2011. - 79 p.
3. Handbook of the recipient of a scientific degree: Collection. norms dock. and information materials on certification issues. of science of highly qualified personnel / Reg. G.Yu.I. Tsekov; edited by V.D. Bondarenko – 5th ed., corr. and added - K.: Ed. "Bull. Higher certification. commission of Ukraine": "Toloka" Publishing House, 2011. - 56 p.
4. How to properly draw up a dissertation and certification case documents: Collect. norms dock. on issues of attestation of sciences. of highly qualified personnel / Reg. L.I. Miroshnychenko. - K.: "Toloka" Publishing House, 2012. - 56 p.

Additional literature:

1. YOU. Shtanko Philosophy and methodology of science. Study guide for graduate and undergraduate students of natural sciences and technical universities. Kharkov: Khnure, 2002. p. 292.

2. *Basics of scientific research: Organization of scientific research: Synopsis of lectures for master's students of the instrument-making faculty / Compendium. NO. Burau - K.: NTUU "KPI", 2007. - 33 p.*
3. *Kolesnikov O. V. Fundamentals of scientific research. 2nd edition ex. and add. Education guide. - K.: Center of educational literature, 2011. - 144 p.*
4. *Solovyov S.M. Basics of the scientific research. Tutorial. - K.: Center of Educational Literature, 2007. - 176 p.*
5. *Tsekhmistrova G.S. Basics of the scientific research. Tutorial. - Kyiv: "Slovo" Publishing House, 2004. - 240 p.*
6. *Romanchikov V.I. Basics of the scientific research. Tutorial. - K.: Center of Educational Literature, 2007. - 254 p.*
7. *Basics of scientific research: a summary of lectures / compiled by E. V. Kolisnichenko. – Sumy: Sumy State University, 2012. – 83 p.*
8. *Pistunov I. M. Fundamentals of scientific research. Compendium. Dnipropetrovsk. 2007*

Information resources on the Internet:

1. <https://www.sciencedirect.com/>
2. <https://www.springer.com/gp>
3. www.scopus.com
4. <https://clarivate.com/products/web-of-science/>
5. www.scholar.google.com.ua
6. www.doaj.org
7. www.narcis.nl
8. <https://royalsociety.org>
9. <http://www.nbuv.gov.ua>
10. <https://www.crossref.org/>
11. <https://www.researchgate.net/>
12. <https://orcid.org/>
13. <https://publons.com/>
14. <https://www.scimagojr.com/>

Educational content

5. Methods of mastering an educational discipline (educational component)

Lecture classes

No. z/p	<i>The name of the topic of the lecture and a list of the main questions (a list of didactic tools, tasks on the SRS with reference to the literature)</i>
1	<p><i>The essence of science. History and regularities of the development of science.</i></p> <p><i>literature [1-4]</i></p> <p><i>Tasks on SRS: Rejected scientific theories. [1-4]</i></p>

2	<p>Scientific terminology. Results of scientific work. Law. Hypothesis. Theory.</p> <p>literature [1-4]</p> <p>Tasks on SRS:Examples of the development of scientific theories[1-4]</p>
3	<p>Empirical research methods. Experimental methods. Active and passive experiment. Experiment planning.</p> <p>literature [1-4]</p> <p>Tasks on SRS:Selection of parameters to be measured during the experiment[1-4]</p>
4	<p>Theoretical research methods. Deductive and inductive methods. Modeling. Theory of similarity.</p> <p>literature [1-4]</p> <p>Tasks on SRS:The method of dimensional analysis.[1-4]</p>
5	<p>Interpretation of the results of scientific research. Formulation of conclusions. Publication of research results</p> <p>literature [1-4]</p> <p>Tasks on SRS:Requirements for publications.[1-4]</p>

Practical training

The main tasks of the cycle of practical classes

1. Systematization and consolidation of methods of experiment planning and analysis of results.
2. Gaining experience in using mathematical data processing methods.
3. Gaining experience in experiment planning and data processing

No. z/p	Name of the subject of the lesson
1	Planning experiments. A complete factorial experiment. Construction of the planning matrix.
2	Finding regression coefficients
3	Determining the significance of regression coefficients
4	A small factorial experiment
5	Approximation by a linear function and verification of the existence condition of dependence
6	Determination of measurement accuracy based on current results
7	Univariate variance analysis
8	Individual cases of variance analysis
9	Test.

6. Independent work of student

Independent work takes up 55% of the time of studying the discipline, including preparation for the test. The main task of students' independent work is to acquire knowledge from the course that was not included in the list of lecture questions by personally searching for information, forming an active

interest in a creative approach to educational work. In the process of independent work within the framework of the educational component, the student must learn to use the methods of scientific knowledge used in chemical engineering.

No. z/p	Names of topics and questions that are submitted for independent study and references to educational literature	Number of hours of SRS
1	Knowledge. Scientific and everyday knowledge.[1-4]	2
2	Empirical research methods in chemical engineering[1-4]	4
3	Theoretical research methods in chemical engineering[1-4]	4
4	Approaches to process modeling in chemical engineering[1-4]	4
5	Preparation for lectures	5
6	Preparation for practical classes	8
7	Preparation for the test	6
		33

Policy and control

7. Policy of academic discipline (educational component)

Rules of attending classes and behavior in classes

Attending classes is a mandatory component of the assessment. Students are obliged to take an active part in the educational process, not to be late for classes and not to miss them without a good reason, not to interfere with the teacher conducting classes, not to be distracted by actions unrelated to the educational process. When solving problems in practical classes, students can use any sources of information and means of calculations. All tasks are performed individually.

Rules for assigning incentive and penalty points

- incentive points can be awarded by the teacher exclusively for the performance of creative works in the discipline or additional completion of online specialized courses with the receipt of the appropriate certificate:

But their sum cannot exceed 25% of the rating scale.

- Penalty points are not provided within the academic discipline.

Policy of deadlines and rescheduling

In the event of arrears from the academic discipline or any force majeure circumstances, students should contact the teacher through available (provided by the teacher) communication channels to resolve problematic issues and agree on an algorithm of actions for practice.

Policy of academic integrity

Plagiarism and other forms of dishonest work are unacceptable. Plagiarism includes the absence of references for the use of printed and electronic materials, quotes, opinions of other authors. Inadmissible tips and write-offs during writing tests, conducting classes; passing the exam for another graduate student; copying materials protected by the copyright system without the permission of the author of the work.

The policy and principles of academic integrity are defined in Chapter 3 of the Code of Honor of the National Technical University of Ukraine "Ihor Sikorsky Kyiv Polytechnic Institute". More details:<https://kpi.ua/code>

Policy of academic behavior and ethics

Students should be tolerant, respect the opinions of others, formulate objections in the correct form, constructively support feedback during classes.

Standards of ethical behavior of students and employees are defined in Chapter 2 of the Code of Honor of the National Technical University of Ukraine "Ihor Sikorskyi Kyiv Polytechnic Institute". More details: <https://kpi.ua/code>

8. Types of control and rating system for evaluating learning outcomes (RSO)

All control types and points for each control element are indicated, for example:

1. The rating of the student from the credit module consists of points that the student receives for:

- test survey based on the lecture material (1 survey)
- performance of 8 practical tasks;

2. Scoring criteria:

2.1. The test survey is evaluated out of 20 points

- "excellent", more than 95% of correct answers to test tasks - 18-20 points.
- "good", 75-94% correct answers to test tasks - 14-17 points.
- "satisfactory", 60-74% correct answers to test tasks - 10-13 points.
- "unsatisfactory", incorrect answer - 0 points.

2.2 Performance of practical classes:

- excellent work performance, fluency in defense material - 10 points.
- good level of performance, correct answers to questions during the defense of the work - 7-9 points.
- a sufficient level of work performance, the presence of minor inaccuracies in the answers - 5-6 points.
- poor quality of work, ignorance of theoretical material - 0 points.
- absence from a practical lesson without a valid reason – (-2) points

2.3. The credit control work is evaluated out of 60 points. The control task consists of two practical tasks from the list provided in the appendix to the work program of the credit module.

Each task is evaluated out of 30 points according to the following criteria:

- excellent performance of the task, fluency in defense material - 28-30 points.
- good level of performance, correct answers to questions when defending the task - 23-26 points.
- a sufficient level of task performance, the presence of minor inaccuracies in answers - 20-22 points.
- poor quality of work, ignorance of theoretical material - 0 points.

3. The condition of the first attestation is obtaining at least 20 points and completing 75% of practical work (at the time of attestation). The condition for the second attestation is to obtain at least 36 points and complete all practical work (at the time of attestation).

4. The condition for obtaining a credit or admission to the credit control work is the completion of all practical work.

4. The sum of the rating points received by the student during the semester is transferred to the final grade according to the table. If the sum of points is less than 60 points, the student completes a credit test. In this case, the sum of the points for the performance of part-time tasks and the credit control work is transferred to the final grade according to the table.

5. A student who received at least 60 points in the semester can take part in credit work. In this case, the points obtained by him on the control work with the addition of 50% of the points obtained in the semester are final.

5. Table of transfer of rating points to grades.

Table of correspondence of rating points to grades on the university scale:

Scores	Rating
100-95	Perfectly
94-85	Very good
84-75	Fine
74-65	Satisfactorily

64-60	Enough
Less than 60	Unsatisfactorily
Admission conditions not met	Not allowed

9. Additional information on the discipline (educational component)

- *Based on the materials of the discipline, a course of video lectures has been developed, which is available on the lecturer's personal channel on YouTube video hosting. Access <https://www.youtube.com/channel/UCrb-KAuZSAby3EhP6nVdrSw>*

Working program of the academic discipline (syllabus):

Folded associate professor MAHNV, Ph.D., Assoc. Serhii GULIENKO

Approved by the MAHNV Department (protocol No. 19 dated 17.05.2023)

Agreed by the methodical committee of the faculty (protocol No. 10 dated 05/26/2023)