

Vinnitsia National Technical University
Faculty power industry and electromechanics
Department power stations and systems

PHILOSOPHY OF SCIENCE AND ENGINEERING

**Mandatory
Professional
II (master's) level higher education**

Field of knowledge **14 Electrical engineering n**
Specialty **141 Electricity, electrical engineering and electromechanics**

Educational programs: **Philosophy of Science and Engineering**

Teacher: **Khoma Oleg**
Language teaching: **Ukrainian**

Semester - **1**
Credits EPSTS **3**
Lectures **18 hours**
Practical - **18 hours**
Independent work - **54 hours**
Type of control: **credit**

Prerequisites for studying the discipline

The discipline "Philosophy of science and engineering" is based on systems and concepts of philosophy, philosophy of science, philosophy of engineering. This discipline is related to and complements such disciplines as: philosophy, history and culture of Ukraine, psychology and political science.

Competencies that the applicant must master as a result of studying the discipline

GC01. Ability to abstract thinking, analysis and synthesis, personal and professional development.

GC02. Ability to search, process and analyze information from various sources, as well as possess critical thinking skills.

SC03. The ability to plan, organize and conduct scientific research, as well as clear and unambiguous communication of own knowledge, conclusions and arguments to specialists and non-specialists in the field of electric power and electrical engineering, in particular to students.

SK08. The ability to solve problems in new or unfamiliar environments in the situation of incomplete or limited information, taking into account aspects of social and

ethical responsibility related to the problems of nature protection, sustainable development, health and safety and risk assessments in electricity.

SC09. The ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the implementation of technical solutions in electric power, electrical engineering and electromechanics.

Program results of studying the discipline

PR19. To demonstrate respect for the identity of representatives of different cultures and faiths.

The current and final control of the knowledge of the applicants is carried out by means of a frontal, individual or combined survey during practical classes, colloquiums, testing.

Independent work includes the study of some course topics, preparation for practical classes, colloquiums, and testing.

1. Description of the academic discipline

Name of indicators	Field of knowledge, specialty, educational programs, level of higher education	Characteristics of the academic discipline	
		full-time education	external form of education
The number of credits is 3	Branch of knowledge 14 Electrical engineering	Mandatory professional	
Modules - 2	Specialty 141 Power engineering, electrical engineering and electromechanics Educational program: Philosophy of Science and Engineering	Year of training (course):	
Content modules – 2		1	1
		Semester	
		1st	1st
The total number of hours is 90		Lectures	
Weekly hours for full-time education: classrooms - 2	Level of higher education: second (master's)	18	10
		Practical, seminar	
		18	5

student's independent work - 3		
	Independent work	
	54	75
	type of control	
	credit	

1. Program of educational discipline

Information volume of the academic discipline

Content module 1

Topic 1. Philosophy, science, philosophy of science

Difficulties in defining the concept of "science".

Historical types of interaction between philosophy and science: natural philosophical and positivist models.

Variety of science problems and attempts to classify them. Concept of philosophical problems of science and their types. Problems of scientific knowledge, their historical psychological component.

Concept of reflection. Philosophical reflection on science. Philosophy of science as a branch of philosophical knowledge. Connection of the philosophy of science with the history of science and other disciplines.

Topic 2. The nature of scientific knowledge

Epistemology as a special branch of philosophy. The problem of the typology of knowledge is Kant's problem). Science is not science: the problem of demarcation. Scientific and mythological knowledge. Scientific and everyday knowledge. Scientific and religious knowledge. Scientific and non-scientific knowledge.

Science as a special type of knowledge: the objective determination of scientific knowledge, its systematicity, objective truth, the need for the growth of scientific knowledge. The concept of the form of scientific knowledge as a system-forming element of science. The language of science.

Science as a special type of activity. Scientific knowledge: its purpose, content, purpose. Concept of scientific method. Scientific method and rule. Scientific research as a scientific search. The concept of scientific creativity.

Science as a socio-cultural phenomenon. Concept of scientific community. Science and morality. Scientific ethos. Science as a trinity of knowledge, activity and social forms of its organization. Basic functions of science. Epistemological functions of science: descriptive, explanatory, predictive. Hempel Oppenheim's nomological model of explanation.

Topic 3. The structure of scientific knowledge

Empirical and theoretical levels of scientific knowledge. Empirical forms of scientific knowledge: scientific fact; empirical data: empirical law; model object, theoretical forms of scientific knowledge: scientific concept: idealization: and scientific problem; scientific hypothesis; theoretical model: theoretical law; scientific theory.

The structure of scientific theory. Theory and model. Theory and reality.

Scientific theory and research program. Basic research programs in the history of science. The scientific picture of the world as a form of scientific knowledge. Scientific picture of the world and scientific theory. The main pictures of the world in the history of science. Disciplinary structure of science (classification of sciences).

Content module 2

Topic 4. Dynamics of scientific knowledge

Peculiarities of the scientific method. Method, technique, methodology. Two levels of methodological analysis of science and two methodologies.

Forms and methods of scientific knowledge. Method and theory.

Classification of scientific methods. Empirical methods of scientific knowledge: observation, measurement, experiment. Theoretical methods of scientific knowledge: idealization, axiomatic method, mathematical modeling, hypothetical-deductive method, imaginary experiment, etc. General methods of scientific knowledge: abstraction, analysis and synthesis, induction and deduction, analogy, modeling, "cycle" of scientific research.

Topic 5. Methodology of scientific knowledge

Scientific knowledge as a creative process. Scientific activity is the only productive (creative) and reproductive activity.

Rule, method, principle. Methodology of scientific activity, methodological principle.

Methodological principles and their role in scientific knowledge. The principle of correspondence, the principle of additionality, the principle of observability, the principle of symmetry. More "liberal" regulative principles of scientific knowledge: the principle of simplicity, the principle of beauty, etc.

Fundamental and applied research in science.

Methodology of science and scientific rationality.

Scientific search and intuition. Logic, intuition, art. Discursive and intuitive in scientific research.

Topic 6. Philosophy of technology as a special philosophical discipline

The concept of technology. Technology as a collection of artifacts; The concept of "techne" and its transformation. Formation of technology and driving forces of its development. Technique and technology.

The evolution of the relationship between science and technology and the modern transformation of the relationship. Concept of technoscience.

Scientific research (scientific search) and engineering activity. The nature of technical art.

Research activity and the concept of the theory of solving research problems.

The need for a philosophical understanding of technology. Concept of philosophy

of technology and historical stages of its development. Philosophy of technology and philosophy of science, their relationship. The main gradations in the philosophy of technology are methodological and humanitarian.

Technology as a special knowledge and as a special activity. Engineering activity and technical creativity. Technocratic thinking and ways to overcome its limitations.

Technology in the sociocultural context. The change in the nature of interaction between technology and science, as well as their social status in the 20th century. Scientific and technical progress and philosophical understanding of its contradictions: scientist and anti-scientist tendencies. Science, technology, humanism.

Technology in a philosophical and anthropological context. Technology in the context of global problems. Ethics in a "technical" society. Perspectives of the philosophy of technology.

Topics of practical classes

#	Topic name	Hours	
		full-time education	external form of education
	<i>Content module 1</i>		
1	Historical types of interaction between philosophy and science: natural philosophical and positivist models.	3	1
2	Epistemology as a special branch of philosophy. The problem of the typology of knowledge is Kant's problem). Science is not science: the problem of demarcation. Scientific and mythological knowledge. Scientific and everyday knowledge. Scientific and religious knowledge. Scientific and non-scientific knowledge.	3	1
3	Empirical and theoretical levels of scientific knowledge. Empirical forms of scientific knowledge: scientific fact; empirical data: empirical law; model object, theoretical forms of scientific knowledge: scientific concept; idealization: and scientific problem; scientific hypothesis; theoretical model: theoretical law; scientific theory.	3	1
	<i>Content module 2</i>		
4	Peculiarities of the scientific method. Method, technique, methodology. Two levels of methodological analysis of science and two methodologies.	3	0,5
5	Scientific knowledge as a creative process. Scientific activity is the only productive (creative) and reproductive activity. Rule, method, principle. Methodology of scientific activity, methodological principle.	3	0,5
6	The concept of technology. Technology as a collection of	3	1

	artifacts. The concept of "techne" and its transformation. Formation of technology and driving forces of its development. Technique and technology.		
	Total:	18	5

Independent work

#	Topic name	Hours	
		full-time education	external form of education
1	Concept of reflection. Philosophical reflection on science. Philosophy of science as a branch of philosophical knowledge. Connection of the philosophy of science with the history of science and other disciplines.	9	13
2	Science as a special type of activity. Scientific knowledge: its purpose, content, purpose. Concept of scientific method. Scientific method and rule. Scientific research as a scientific search. The concept of scientific creativity.	9	12
3	Scientific theory and research program. Basic research programs in the history of science. The scientific picture of the world as a form of scientific knowledge. Scientific picture of the world and scientific theory. The main pictures of the world in the history of science. Disciplinary structure of science (classification of sciences).	9	12
4	General methods of scientific knowledge: abstraction, analysis and synthesis, induction and deduction, analogy, modeling, "Cycle" of scientific research.	9	13
5	Fundamental and applied research in science. Methodology of science and scientific rationality. Scientific search and intuition. Logic, intuition, art. Discursive and intuitive in scientific research.	9	12
6	Technology in a philosophical and anthropological context. Technology in the context of global problems. Ethics in a "technical" society. Perspectives of the philosophy of technology.	9	13
	<i>Усього годин</i>	54	75

Individual tasks

According to the decision of the department, the winners prepare creative tasks, essays on individual course topics and reports for the annual scientific and theoretical conference of the VNTU divisions.

Teaching methods

Lecture, problem lecture, demonstration, in particular, with the use of multimedia teaching aids, practical work, preparation of creative works, abstracts, reports of a scientific and research nature, in particular, for the annual scientific and technical conference of the VNTU divisions.

Control methods

Lecture, problem lecture, demonstration, in particular, with the use of multimedia teaching aids, practical work, preparation of creative works, abstracts, reports of a scientific and research nature, in particular, for the annual scientific and technical conference of the VNTU divisions.

Distribution of points received by students

Table 1 Distribution of points for mastering content modules during the 2nd semester for full-time students

Current testing and independent work						Final test	Sum
Content module 1			Content module 2			25 points	100
T1	T2	T3	T4	T5	T6		
35 points			40 points				

T1, T2 ... T6 – topics of content modules.

Table 2 Evaluation of students' knowledge, abilities and skills in certain types of work and in general by modules (in points)

Type of work	Module 1	Module 2	Together
1. Practical lessons	15	15	30
2. Current knowledge control tests	5	10	15
3. Colloquium	15	15	30
Всього	35	40	75

Methodical support

1. Work program of the educational discipline "Philosophy of Science and Engineering".
2. Synopsis of lectures.
3. Methodical instructions for practical classes.
4. Methodical instructions for independent work.
5. Questions for colloquiums.
6. Current knowledge control tests.
7. Final knowledge control tests.
8. A set of complex control works.

Course policy

Applicants and teachers must adhere to the norms of ensuring honor, dignity, mutual respect and trust, equality and tolerance of all participants in the educational process by observing the principles of academic integrity set forth in the "Regulations on Academic Integrity at VNTU".

In order to prevent and detect plagiarism in academic works, to develop the skills of correct work with sources of information and to implement the practice of proper citation, compliance with the requirements of scientific ethics and respect for intellectual property, and activation of independence and individuality when creating an author's work and responsibility for violations of generally accepted rules of citation should be observed of norms "Regulations on the prevention of academic plagiarism and the procedure for its detection in educational, scientific, qualification and scientific-methodological works at VNTU".

In order to recognize the learning results obtained during non-formal and/or informal education (which was obtained according to educational programs and did not involve the awarding of state-recognized educational qualifications by education level, but could end with the awarding of professional and/or partial educational qualifications, as well as education that was carried out in the manner of self-education), applicants can use the relevant procedures specified in the **"Regulations on the procedure for recognizing learning results obtained through informal and/or informal education at VNTU"**.

Applicants have the right to appeal the results of intermediate and final control measures, but only on the basis of reasoned explanations, in accordance with the **"Procedure for the organization and conduct of assessments, differentiated assessments, examinations at VNTU"**, as well as by directly contacting the educational ombudsman, according to the **"Regulations on the educational ombudsman on the rights of VNTU students"**.

In order to resolve conflict situations that may arise between applicants and other participants of the educational process and/or to prevent the occurrence of conflict situations, one should be familiar with the norms of the **"Code of Ethics of VNTU"**.

VNTU applicants must be guided by the principle of "zero tolerance" to any manifestations of corruption and must take all measures provided by law to prevent, detect and counter corruption and related actions (practices), in accordance with the VNTU Anti-Corruption Program .

These documents are published on the VNTU website:
<https://vntu.edu.ua/uk/public-info/zag.html> .

Recommended Books

1. Christian, H., & Johnsen, G. (2023). *Science Meets Philosophy: What Makes Science Divided but Still Significant*. Oxon, UK: Routledge.
2. Felgner, U. (2023). *Philosophy of Mathematics in Antiquity and in Modern Times*. Cham: Birkhäuser. <https://doi.org/10.1007/978-3-031-27304-9>
3. Hale, B., Light, A., & Lawhon, L. (Eds). (2023). *The Routledge Companion to Environmental Ethics*. Oxon, UK: Routledge. <https://doi.org/10.4324/9781315768090>
4. Hansson, S. O., (2021, Fall). *Science and Pseudo-Science*. The Stanford Encyclopedia of Philosophy. <https://plato.stanford.edu/archives/fall2021/entries/pseudo-science>
5. Hepburn, B., & Andersen, H. (2021, Summer). *Scientific Method*. The Stanford Encyclopedia of Philosophy.

- <https://plato.stanford.edu/archives/sum2021/entries/scientific-method>
6. Ludwig, D., & Ruphy, S. (2021, Winter). *Scientific Pluralism*. The Stanford Encyclopedia of Philosophy. <https://plato.stanford.edu/archives/win2021/entries/scientific-pluralism>
 7. Reiss, J., & Sprenger, J. (2020, Winter). *Scientific Objectivity*. The Stanford Encyclopedia of Philosophy. <https://plato.stanford.edu/archives/win2020/entries/scientific-objectivity>
 8. Rowbottom, D. P. (2023). *Scientific Progress*. Cambridge: Cambridge University Press. <https://doi.org/10.1017/9781108625753>
 9. Schickore, J. (2022, Winter). *Scientific Discovery*. The Stanford Encyclopedia of Philosophy. <https://plato.stanford.edu/archives/win2022/entries/scientific-discovery/>
 10. Scott, F., & Aikin, R. (Eds). (2023). *The Routledge Companion to Pragmatism*. Oxon, UK: Routledge.
 11. Thornton, S. (2023, Winter). *Karl Popper*. The Stanford Encyclopedia of Philosophy. <https://plato.stanford.edu/archives/win2023/entries/popper>