Національний технічний університет України
**«КИЇВСЬКИЙ ПОЛІТЕХНІЧНИЙ ІНСТИТУТ
імені ІГОРЯ СІКОРСЬКОГО»**

Кафедра філософії

LOGIC

Work program of the discipline (Syllabus)

Details of the discipline	
Level of higher education	*First (bachelor's)*
Branch of knowledge	*10 Natural sciences*
Specialty	*105 Applied Physics and Nanomaterials*
Educational program	*Applied physics*
Discipline status	*Selective*
Form of study	*eye (day)*
Year of preparation, semester	*course, autumn / spring semester*
The scope of discipline	Total number: 60 hours Lectures: 18 hours. Practical classes: 18 hours. Independent work of students: 24 hours.
Semester control / control measures	*Test*
Lessons schedule	*http://rozklad.kpi.ua/Schedules/ViewSchedule.aspx?v=7ce805c3-c7b4-4cc7-954e-1245a862edeb*
Language of instruction	*English*
Information about course leader / teachers	Candidate of Philosophical Sciences, Potishchuk Olga Olehivna, 0939617661
Course placement	Remote resource link (Moodle) https://do.ipo.kpi.ua/course/view.php?id=3273

Curriculum

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

The main purpose of the discipline «Logic» is the formation of the ability to solve complex specialized problems and practical problems of applied physics and nanomaterials, which involves the application of theories and methods of physics, mathematics and engineering and is characterized by complexity and uncertainty, which involves studying and applying the laws of logic: the law of identity, the exclusion of contradictions, the exclusion of the third, sufficient grounds and detailed acquaintance with the rules of construction and methods of effective use in the process of thinking such logical forms as concepts, judgments, inferences. Forms of thinking are considered not only as a tool for learning about the world, but also as a means of improving the effectiveness of communication.

It should be noted that the laws of formal logic underlie modern computer programming and mathematical modeling, so this function of logic is considered in particular detail. In this regard, the main focus is on the study of deductive reasoning. But the work on the generalization of empirical material requires mastery and methods of inductive research, the study of which is devoted to a separate topic.

During the study of the discipline, higher education students will acquire the following abilities and skills:

knowledge: basic laws of formal logic; structure and general characteristics of logical forms; requirements for the definition and division of concepts; classification of judgments on various bases; values of logical connectors; classification of inferences by the number of bases, by composition, by the direction of the conclusion, by the nature of the conclusion, by the type of bases; operations by means of which direct inferences are formed; structure and rules of figures of simple categorical syllogism; main types of complex, abbreviated and complex abbreviated inferences; general logical methods such as analysis, synthesis, comparison, deduction, induction; principles of dialectical logic.

skills: to reconcile own thinking with the laws of logic; competently form concepts and give them the correct definitions; analyze reasoning in terms of compliance with their rules of logic; use the rules of constructing formal-logical theories to express scientific results; correctly prove and disprove; avoid formal contradictions; correctly formulate and prove hypotheses; isolate sophisms and paralogisms and find logical errors; use the rules of scientific induction to construct generalizations.

experience: analysis of natural language texts and scientific texts in terms of their logical structure; establishing relations between the concepts of volume and content; construction of complex judgments and verification of their formalization; determination of the truth of statements by means of tabular construction of logic of statements; correct construction of inferences; analysis of inferences in terms of compliance with their inference rules.

General competencies of SVO

LC 8: Ability to apply interpersonal skills.

LC 11: The ability to exercise their rights and responsibilities as a member of society, to realize the values of civil (free democratic) society and the need for its sustainable development, the rule of law, human and civil rights and freedoms in Ukraine.

Professional competencies of SVO

FC 6: Ability to use modern theoretical concepts in physics to analyze physical systems.

Program learning outcomes

PRN 9: Present the results of research and development to specialists and non-specialists, argue their own position.

PRN 11: Know the goals of sustainable development and the opportunities of their professional field to achieve them, including in Ukraine.

1. Prerequisites and postrequisites of the discipline (place in the structural and logical scheme of education according to the relevant educational program)

To master the material of the course «Logic» students must know the course of physics and mathematics in the school curriculum and learn the terminology and concepts of the courses:

1. Mathematical analysis;
2. Mechanics.

Also have a basic level of English not lower than A2.

1. The content of the discipline

Topic 1. The subject and meaning of logic

Topic 2. Principles of dialectical logic

Topic 3. Laws of logic

Topic 4. The concept as an elementary form of thinking

Topic 5. Judgments

Topic 6. Inference

Topic 7. A simple categorical syllogism

Topic 8. Hypothesis, analogy, induction

Topic 9. Proof and refutation

Topic 10. Methods of inductive research

Topic 11. The nature of thinking

Topic 12. Complex inferences

Training materials and resources
Recommended Books
Basic:

1. Arkhipova, E.A, Pikhorovich, V.D, Potishchuk, O.O. (2015). Logic: textbook Dnipropetrovsk: Serednyak TK.[In Ukrainian].

2. Zhol, K.K.(2002). Introduction to modern logic: textbook. way. for students. humanities. special higher textbook institutions. - Kyiv: Lybid. [In Ukrainian].

3. Konversky, A. E. (1998). Logic Textbook for students higher. textbook institutions. - Kyiv: The fourth wave. [In Ukrainian].

4. Restall G. (2006). Logic An Introduction by Routledge. – London. [In English].

Additional:

1. Arno A., Nicole P. (1991). Logic, or the art of thinking. - Moscow: Nauka. [In Russian].

2. Berkov, V.F, Yaskevich, J.S, Pavlyukevich, V.I. (1998). Logic: Textbook. for universities. - Minsk: Tetrasistems. [In Russian].

3. Zherebkin, V.E. (2008). Logic textbook. – Kyiv:Znanna. [In Ukrainian].

4. Ivanov, E.A. (1996). Logic / E.A. Ivanov. - [Textbook]. - Moscow: Izd-vo BEK. [In Russian].

5. Ivin, A.A. (1997). Logic. - [Textbook. Manual]. - Moscow: Znanie. [In Russian].

6. Ilyenkov, E.V. (1997). Dialectics of abstract and concrete in scientific-theoretical thinking. - Moscow: OSSPEN. [In Russian].

7. Lars Kristiansen(2020). A Friendly Introduction to Mathematical Logic/ - Publisher: Milne Library Authors. [In English].

8. Narsky, I.S. (1969) Dialectical contradiction and logic of cognition. - Moscow. Nauka. [In Russian].

9. Pocheptsov, G.A. (2001). Russian semiotics: ideas, methods, personalities, history. - Moscow. [In Russian].

10. Sorina, G.V. (1996). Meskov VS Logic in the system of culture / GV Sorina, VS Meskov // Questions of philosophy. - № 2.- Moscow. [In Russian].

11. Tarsky A. (1972). Truth and proof // Vopr. philosophy. - 1972. - № 8. - Moscow. [In Russian].

12. Tarsky, A. (1999) The concept of truth in the languages of deductive sciences // Philosophy and logic of the Lviv-Warsaw school. – Moscow. [In Russian].

13. Frege, G. (1997). Meaning and denotation // Semiotics and Informatics. - Moscow. [In Russian].

14. Chelpanov, G.I. (1994). Textbook of logic. - Moscow: Publishing group «Progress». [In Russian].

15. Wolf Abraham. (2020). Textbook of Logic Published by Routledge. Allen and Unwin. [In English].

Information resources
Electronic textbooks
(access is provided in the Igor Sikorsky KPI network: library, educational buildings, dormitories)

1. Konversky, A. E. (1998). Logic Textbook for students higher. textbook institutions. - Kyiv: The fourth wave. [In Ukrainian].
   http://culonline.com.ua/Books/Logika_tradic-Konverskiy_CD.pdf#toolbar=0
2. Arkhipova, E.A, Pikhorovich, V.D, Potishchuk, O.O. (2015). Logic: textbook Dnipropetrovsk: Serednyak TK.[In Ukrainian].
   http://ela.kpi.ua/jspui/handle/123456789/26008?mode=full

Educational content

1. Methods of mastering the discipline (educational component)

Lecture classes

Students are encouraged to review the lists of references at the end of each topic. Also

for in-depth study of the issues, it is advisable to use not only the recommended thematic list, but also the sources listed in section 4.

№ з/п	The topic of the lecture and a list of key issues (list of teaching aids, references to literature and tasks on VTS)
1	**Topic 1. The subject and meaning of logic** 1. Thinking as a subject of logic. 2. Logic in the system of sciences. 3. The main concepts of the origin of thinking. 4. The main stages of formation of logical science 5. Thinking and activity. Basic literature: 1, 3, 4 Additional literature: 1, 2, 3, 4, 5, 14, 15. Tasks for VTS: 1. Give a written description of the definitions: «thinking», «consciousness», «abstract thinking».
2	**Topic 2. Principles of dialectical logic.** 1. The principle of development. 2. The principle of connection of everything with everything. 3. The principle of coincidence of historical and logical. Basic literature: 1, 3 Additional literature: 4, 9, 10, 15 Tasks for VTS: 1. Describe the basic principles of dialectical logic.

3	**Topic 3. Laws of logic.** 1. Laws of activity and laws of thinking. 2. The law of identity. 3. The law of exclusion of contradictions. 4. The law of the excluded third. 5. The law of sufficient grounds. 6. The ratio of formal and dialectical logic Basic literature: 2, 3, 4 Supporting literature: 1, 2, 3, 4, 5, 6, 7, 9,13, 14. Tasks for VTS: 1. Describe the basic laws of formal logic.
4	**Topic 4. The concept as an elementary form of thinking.** 1. General characteristics of the concept. 2. See to understand. 3. The relationship between concepts. 4. Operations on the formation of concepts. Basic literature: 1, 2, 3, 4 Supporting literature: 1, 2, 3, 4, 5, 6, 7, 12, 13, 15. Tasks on VTS: 1. Give an example of general non-registering concepts. 2. What kind of division is most often used in science?
5.	**Topic 5. Judgments.** 1. The structure of judgment. 2. Classification of judgments. 3. The relationship between simple categorical judgments of truth. 4. Distribution of terms in simple categorical judgments. 5. Complex judgments. Basic literature: 2, 4 Supporting literature: 1, 2, 3, 4, 6, 7, 11, 14, 15. Tasks on VTS: 1. Give a general description of modal judgments. 2. Come up with a complex judgment, which would consist of six simple ones, and use the table to check whether it is a logical law.
6.	**Topic 6. Inference.** 1.General characteristics of inference. 2. Classification of inferences. 3. Logical operations for the formation of direct inferences. 4. Conditional and divisive inferences. Basic literature: 2, 3 Supporting literature: 1, 2, 3, 4, 5, 6, 7, 15. VTS task: What is the logical role of dilemmas.

7.	**Topic 7. A simple categorical syllogism.** 1. The structure of a simple categorical syllogism. 2. Axiom of syllogism. 3. Rules of syllogism: 4. Moduses of syllogism figures. 5. Complex and complex abbreviated inferences. Basic literature: 1, 3 Supporting literature: 1, 2, 9, 10, 11, 13, 15. VTS Task: Give an example of a simple categorical syllogism?
8.	**Topic 8. Hypothesis, analogy, induction.** 1. The concept and structure of the hypothesis. 2. Conditions for effective application of the analogy. 3. Popular and scientific induction. 4. Methods of inductive research. Basic literature: 2, 4 Supporting literature: 1, 2, 3, 4, 6, 7, 9, 11, 15. Tasks on VTS: 1. How does a hypothesis differ from a theory? 2. Name the characteristics of complete induction.
9.	**Topic 9. Proof and refutation.** 1. General characteristics of the proof 2. Classification of evidence. 3. Refutation. Basic literature: 3, 4 Supporting literature: 1, 2, 6, 7, 9, 11, 12, 15. VTS Task: What is the basis for dividing evidence into direct and indirect?

The name of the topics and a list of key issues **(list of didactic support, references)**
Topic 1. The subject and meaning of logic
Development of thinking and development of ideas about thinking. The main stages of formation of logical science. Thinking and language. The main concepts of the origin of thinking. Thinking and activity. Social and individual thinking. Basic literature: 1, 2, 4 Additional literature: 4, 9, 10, 12
Topic 2. Principles of dialectical logic
The principle of development. The principle of connection of everything with everything. The principle of coincidence of historical and logical. Basic literature: 1, 3, 4 Additional literature: 4, 9, 10, 13

Topic 3. Laws of logic
The law of identity. The law of exclusion of contradictions. The law of the excluded third. The law of sufficient grounds. Basic literature: 1, 4 Additional literature: 1, 3, 4, 8, 12, 13
Topic 4. The concept as an elementary form of thinking
Concepts in formal and dialectical logic. Classification of concepts. The relationship between concepts. Generalization and constraint operations. Analysis and synthesis. Comparison. Definition of concepts. Separation of concepts. Basic literature: 1, 4 Additional literature: 3, 4, 5, 6, 8,11
Topic 5. Judgments
General characteristics of judgments. The structure of judgment. Types of judgments. The relationship between simple categorical judgments of truth. Logical square. Distribution of terms in simple categorical judgments. Complex judgments. Tabular construction of the logic of statements. Basic literature: 2, 4 Supporting literature: 1, 2, 3, 4, 6, 7, 11, 14, 15.
Topic 6. Inference
Structure and conditions of truth of inferences. Immediate inferences. Operations of transformation, inversion and opposition of the predicate. Modus ponens. Modus tollens. Dilemmas. Ponendo tollenc. Tollendo ponens. Conditional inferences. Complex conditions inputs. Basic literature: 1, 3 Additional literature: 1, 2, 7, 11, 14
Topic 7. A simple categorical syllogism
General characteristics of a simple categorical syllogism. The structure of the syllogism. Axiom of syllogism. Rules of syllogism. Figures of the syllogism. Moduses of syllogism figures. Basic literature: 2, 3 Additional literature: 4, 6, 11, 14
Topic 8. Hypothesis, analogy, induction
Hypothesis. Analogy. Induction. Basic literature: 1, 2, 3 Additional literature: 2, 5, 6, 11, 14

Topic 9. Proof and refutation
The concept of proof and its logical structure. The main types of arguments. The concept of refutation, its logical structure. Rules of proof and refutation. Basic literature: 1, 3, 4 Additional literature: 3, 6, 12, 14

To perform express control it is necessary to attend lectures and seminars, to work out problematic issues on your own.

1. Independent student work

Independent work of students aims to develop creative abilities and activate their development.

language activities, the formation of the need for continuous self-replenishment of knowledge and development

moral and volitional efforts. The task of independent work of students is to teach students independently

work with literature, creatively perceive educational material and comprehend it and form

skills for daily work in order to obtain and generalize knowledge, skills and abilities.

The following types of tasks are assigned to independent work:

-processing and comprehension of information obtained directly in the classroom;

- work with relevant textbooks and personal lecture notes;

- performance of preparatory work of pre-express control;

- preparation for the semester control.

Policy and control

1. The policy of the discipline (educational component)

Attending classes

Attendance is not mandatory, the final rating of the student is formed solely on the basis of assessment of learning outcomes.

Calendar boundary control

Intermediate attestation of students (hereinafter - attestation) is a calendar boundary control. The purpose of the certification is to improve the quality of student learning and monitor the implementation of the schedule of the educational process by students.

Criterion		The first certification	The second certification
Term of certification		Week 8	Week 14
Conditions for obtaining certification	Current rating	≥ 15 points	≥ 40 points

Academic integrity

The policy and principles of academic integrity are defined in Section 3 of the Code of Honor of the National Technical University of Ukraine «Kyiv Polytechnic Institute named after Igor Sikorsky». Details: https://kpi.ua/code.

Norms of ethical behavior

Norms of ethical behavior of students and employees are defined in Section 2 of the Code of Honor of the National Technical University of Ukraine «Kyiv Polytechnic Institute named after Igor Sikorsky». Details: https://kpi.ua/code.

Procedure for appealing the results of control measures

Students have the opportunity to raise any issue related to the control procedure and expect it to be addressed according to predefined procedures.

Students have the right to challenge the results of the control measures, but it is obligatory to explain, with which criterion they do not agree according to the assessment.

1. Types of control and rating system for assessing learning outcomes (RSO)
Rating system for assessing learning outcomes

№ з/п	Control measure	%	Weight point	Кіл-ть	Total
1.	Work on seminars	72%	8	9	72
2	Express control	28%	14	2	28
	Total:				100

Express control is estimated from 1 to 12 points, each error is estimated at -1 point.

Completion of the task with the topic is evaluated at the rate of 4 points for each correctly completed task - 1 point, if the task is performed correctly, but with errors.

Mandatory conditions for admission to the test:

1. Activity in practical classes;
2. Positive result of the first attestation and the second attestation.
3. Attending lectures.
4. Execution of at least one express control.
5. A minimum of 60 points is earned during the semester.

№ з/п	Control measure	%	Weight point	Кіл-ть	Total
1.	Work on seminars	72%	8	9	72
2	Express control	28%	14	2	28
3.	Test	100	100	1	100
	Total:				100

Semester certification of students

A mandatory condition for admission to the test is that the student writes at least one of the two express tests

Table of translation of rating points to grades on a university scale

Rating points, RD	Score for university scale
95 ≤ RD ≤ 100	Perfectly
85 ≤ RD ≤ 94	Very good
75 ≤ RD ≤ 84	Fine
65 ≤ RD ≤ 74	Satisfactorily
60 ≤ RD ≤ 64	Enough
RD < 60	Unsatisfactorily
Failure to comply with the conditions of admission	Not allowed

1. Additional information on the discipline (educational component)
List of questions for credit:

1. Describe the history of logic as a science
2. Explain the tabular construction of the logic of statements.
3. Describe the following concepts: «thinking», «psyche», «substance», «thinking body», «personality» in the works of E. Ilyenkov.
4. Explain what are the modes of syllogism figures.
5. Describe the concept of «dialectical logic».
6. Summarize the classification of inferences.
7. Explain the division of concepts and rules of division.
8. Explain the rules of syllogisms.
9. Name the types of simple judgments.
10. Make a general description of a simple categorical syllogism.
11. Compare the four basic laws of formal logic.
12. Explain the distribution of terms in simple categorical judgments.
13. Name the classification of inferences by composition, number of bases, the nature of the conclusion.
14. Describe the subject and meaning of logic.
15. Make a general description of the laws and principles of dialectical logic.
16. Name the classification of concepts.
17. Give a general description of forms of thinking.
18. Analyze the structure of the hypothesis.
19. Explain the operation of defining concepts.
20. Describe the general characteristics and classification of proof.
21. Compare the principle of development with the principle of interconnection of everything with everything.
22. Make a general description of the concept in formal logic.
23. Make a comparative description of inductive and deductive inferences.
24. Compare complex, complex abbreviated and abbreviated inferences.
25. Name the classification of inferences by the nature of the direction of the output.
26. Give a general description of operations for the formation of concepts.
27. Explain the operation of defining concepts.

28. Explain the methods of inductive research.
29. Analyze the logical operations by which direct inferences are formed.
30. Give a general description of the concept of «formalization».
31. Describe the relationship between concepts.
32. Compare the operation of generalization and restriction of concepts.
33. Describe the concept of «analogy».
34. Analyze the relationship between simple categorical judgments on the meaning of truth.
35 Make a general description of the hypothesis.
36. Generalize the classification of hypotheses.
37. Give a general description of the refutation.
38. Explain the rules of proof and refutation.
39. Describe the types of inferences by analogy.
40. Describe the polysyllogism and its classification.
41. Analyze the entimem and its classification.
42. Describe the content and scope of concepts.
43. Name the combined classification of judgments by quantity and quality.
44. Name the general characteristics of induction.
45. Compare the types of induction (complete and incomplete induction).
47. Analyze the axiom of the syllogism.
48. Determine the difference between formal logic and dialectical.
49. Name the main functions of logic as a science.
50. Make a general description of complex judgments.