GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Methodology of scientific research, PG_00052048		
Field of study	Nanotechnology		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2025/2026
Education level	second-cycle studies	Subject group	
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	2	ECTS credits	1.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Institute of Nanotechnology and Materials Engineering -> Faculty of Applied Physics and Mathematics -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Jarosław Rybicki	
	Teachers	prof. dr hab. inż. Jarosław Rybicki	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	0.0	0.0	0.0	15

E-learning hours included: 0.0

Learning activity and number of study hours

Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
Number of study hours	15	1.0	9.0	25

Subject objectives

The students of exact and technical sciences in a natural, intuitive way "think/reason logically".

The course is intended to systematise and order the knowledge on "contemporary methods of thinking" on phylisofical basis.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W71] has general knowledge in humanistic, social, economic or legal sciences, including their fundamentals and applications	General rules of methodology, understood as "a theory of method" are presented	[SW1] Assessment of factual knowledge
[K7_U71] is able to apply knowledge from humanistic, social, economic or legal sciences in order to solve problems	Examples of applications of formal/ theoretical methodology in practical thinking and formulation of ideas are given	[SU4] Assessment of ability to use methods and tools
[K7_K71] is able to explain the need to apply knowledge from humanistic, social, economic or legal sciences in order to function in a social environment	The strength of formal (semiotic/ formal) methods in resolving of various problems is discussed	[SK4] Assessment of communication skills, including language correctness

Subject contents	Course content – lecture 1. INTRODUCTION. Ontological, psychological, semiotic, theory-cognitive terminology. Formal logic. Philosophy of logic. Methodology vs. science. Science vs. logic. 2. PHENOMENOLOGICAL METHOD. Objectivity of phenomenologists. Return to "issue in itself", intuitive cognition. 3. SEMIOTIC METHODS. Sign and its three dimensions. Formalism. Essence of formalism - calculation. Application of calculation to non-mathematical subjects. Validation of formalism. Eidetic and operational sense. Models. Artificial language. Syntactic rules of sense. Construction of language. Atomic and molecular expressions. Notion of syntactic category. Functors and arguments. Examples of syntactic nonsense. Semantic functions and levels Two semantic functions of sign. Designation and significance. Semantic levels. Language and meta-language. Semantic meaning and verifiability. Rule of verifiability. Verification levels: technical possibility, physical possibility, logical possibility, transempirical possibility. Principle of intersubjectivity. Verifiability of general clauses. 4. AXIOMATIC METHOD. Structure of indirect cognition. Law and rule. Two basic forms of inference: deduction and reduction. Reliable and unreliable rules of inference. Concept of axiomatic system. Structure of axiomatic clause system. Requirements for axiomatic system. Constitutional system. Progressive and regressive deduction. Mathematical logic. Methodological significance. Implication and derivability. Definition and creation of concepts. Basic types of definition. Real and nominal definitions. Syntactic and semantic definitions. Analytical and synthetic definitions. Types of syntactic definitions: clear definitions, contextual definitions, recursive definitions, definitions by axiomatic system. Semantic deictic definitions. Real definitions. Application of axiomatic method. Axiomatization of logic of Hilbert-Ackermann clauses. 5. REDUCTION METHODS. Historical introductory remarks. Concept and division of reduction. Concept of verification and explanation. Regressive reduction. Reduction sciences. Structure of natural sciences. Observation clauses. Progress in natural sciences. Verification of hypotheses. Experience and thinking. Types of explanatory sentences. Causal explanation and teleological explanation. Co-occurrence laws and functional laws. Deterministic laws and statistical laws. Authentic and non-authentic induction. Division of induction. Primary and secondary induction. Qualitative and quantitative induction. Deterministic and statistical induction. Enumerative and eliminatory induction. Postulates of determinism, closed system, relationship between laws, simplicity. 6. SELECTED TOPICS (VARIA). Analogy as a research tool. Nonclassical logics. Mathematical definitions of the truth. Godel theorems and their philosophical implications. Bertrand-Russel mathematics. Mathematicity of nature. Geometricity of the Universe. Structure of pseudo-science.
Prerequisites and co-requisites	

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Written test	51.0%	100.0%

Recommended reading

Basic literature	JM Bochenski,, Contemporary methods of thicking
Supplementary literature	Beyond the Hoax Science, Philosophy and Culture Alan Sokal Oxford Press

	eResources addresses	

Example issues/ example questions/ tasks being completed	1. The two conditions for inference are: - first a statement which ....., - second ..... which allows us to recognize another statement as true on the basis of this statement. 2. The given statements are called .....; the derived statement is called a ..... 3. It is possible to divide all methods of inference into two principal classes, namely ..... and ..... 4. A rule of inference is infallible when, and only when, if the ....., the ..... derived with the help of this rule is also true. 5 The word "axiom" comes from the Greek, where it indicates ..... In Aristotle "axiom" always means a statement which serves as a ..... 6. In modern times with formalization all three conditions imposed on the axioms by Aristotle, i.e. ....., ..., and ..... become untenable. 7. The nominal definitions may be either ..... or ..... The latter is again sub-divided into two types - analytic or ..... and ..... or stipulative definitions. 8. A syntactic definition becomes a semantic definition when the system to which it belongs ..... 9. There are four basic types of syntactic definition: ..... , ... , ... , ...

	are: [illegible]
Practical activites within the subject	Not applicable

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