GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

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| Subject name and code | Methodology of scientific research, PG_00052048 | | |
| Field of study | Nanotechnology | | |
| Date of commencement of studies | October 2022 | Academic year of realisation of subject | 2022/2023 |
| Education level | second-cycle studies | Subject group | Optional subject group<br>Humanistic-social subject group |
| Mode of study | Full-time studies | Mode of delivery | at the university |
| Year of study | 1 | Language of instruction | English |
| Semester of study | 1 | ECTS credits | 1.0 |
| Learning profile | general academic profile | Assessment form | assessment |
| Conducting unit | Instytut Nanotechnologii i Inżynierii Materiałowej -> Faculty of Applied Physics and Mathematics | | |
| Name and surname of lecturer (lecturers) | Subject supervisor | prof. dr hab. inż. Jarosław Rybicki | |
| | Teachers | prof. dr hab. inż. Jarosław Rybicki | |

**Lesson types and methods of instruction**

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

**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 |
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| [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 | Examples of applications of formal/ theoretical methodology in practical thinking and formulation of ideas are given | [SK4] Assessment of communication skills, including language correctness |
| [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 | [SU3] Assessment of ability to use knowledge gained from the subject |
| [K7_W71] has general knowledge in humanistic, social, economic or legal sciences, including their fundamentals and applications | The strength of formal (semiotic/ formal) methods in resolving of various problems is discussed | [SW1] Assessment of factual knowledge |

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| Subject contents | 1. INTRODUCTION. Ontological, psychological, semiotic, theory-cognitive terminology. Formal logic. Philosophy of logic. Methodology vs. science. Science vs. logic.<br><br>2. PHENOMENOLOGICAL METHOD. Objectivity of phenomenologists. Return to "issue in itself", intuitive cognition.<br><br>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.<br><br>Functors and arguments. Examples of syntactic nonsense. Semantic functions and levels<br><br>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.<br><br>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.<br><br>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.<br><br>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 |
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| Written test | 51.0% | 100.0% |

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| Recommended reading | Basic literature: JM Bochenski,, Contemporary methods of thicking |
| | Supplementary literature: Beyond the Hoax<br>Science, Philosophy and Culture<br>Alan Sokal<br><br>Oxford Press |

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| | eResources addresses | Adresy na platformie eNauczanie:<br>Methodology of scientific research_22_23 - Moodle ID: 22698<br>https://enauczanie.pg.edu.pl/moodle/course/view.php?id=22698 |

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

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| Work placement | Not applicable |