

Course title: INTRODUCTION TO LOGIC AND SET THEORY

ECTS credit allocation (and other scores): 4

Semester: autumn

Level of study: ISCED-6 - first-cycle programmes (EQF-6)

Branch of science: Natural sciences

Language: English/Polish

Number of hours per semester: 30 lectures + 30 classes = 60 hours

Course coordinator/ Department and e-mail:

Type of classes: classes and lectures

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Substantive content

CLASSES:

Propositional calculus. The method of checking if the formula is the tautology of propositional calculus. Conjunctive normal form and disjunctive normal form of formulas. First order logic. The algebra of sets. The basic laws of the algebra of sets. The basic laws for relations. Checking the properties of relations. Functions as relations. Images and preimages. Equivalence relations. Examples of equivalence relations. Equivalence classes. Generalized unions, intersections and Cartesian products. Ordered sets. Equinumerosity of sets. Examples of countable sets and continuum sets.

LECTURES:

Propositional calculus. First order logic. Sets, methods of defining sets, the algebra of sets. Relations The basic laws for relations. Checking the properties of relations. Relations, basic types of relations, the algebra of binary relations. Functions as relations. Properties of functions. Images and preimages. Equivalence relations, equivalence classes, the quotient set. The construction of the set of integers and the construction the set of rational numbers. Indexed families of sets. Generalized unions, intersections and Cartesian products. The axiom of choice. Equinumerosity of sets. Cardinal numbers. Cantor–Bernstein theorem. Countable sets and their properties. Continuum sets and their properties. The cardinality of the power set, Cantor's theorem and its consequences. Cardinal Arithmetic. The Continuum Hypothesis. Elements of the theory of partially ordered sets. Linear order and well-order. Transfinite induction. Kuratowski–Zorn lemma.

Learning purpose:

The introduction to basic concepts, facts and methods of logic and set theory necessary in further mathematical education and developing certain habits related to general mathematical culture (precision in defining concepts, method of conducting proofs, searching for examples and counterexamples, etc.).

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On completion of the study programme the graduate will gain:

Knowledge:

The student civilizational significance of mathematics. The student understands the role and importance of proof in mathematics, as well as the concept of the importance of assumptions. The student knows selected concepts, facts and methods of mathematical logic and set theory, necessary in other disciplines of mathematics.



Skills:

The student presents correct mathematical reasoning, formulates theorems and definitions in an understandable way, both verbally and in writing. The student uses the propositional calculus and quantifiers. The student is able to create new objects by constructing quotient spaces or Cartesian products. The student is able to define functions and describe their properties. Understands issues related to various types of infinity and orders in sets.

Social Competencies:

The student is ready to precisely formulate questions to deepen his or her understanding of a given topic or find missing elements of reasoning.

Basic literature:

- 1) W. Guzicki, P. Zakrzewski, Wykłady ze wstępu do matematyki
- 2) H. Rasiowa, Wstęp do matematyki współczesnej

Supplementary literature:

- 1) W. Marek J. Onyszkiewicz, Elementy logiki i teorii mnogości w zadaniach

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The allocated number of ECTS points consists of:

Contact hours with an academic teacher: 2,46 ECTS points,

Student's independent work: 1,54 ECTS points.