**SYLLABUS**

**regarding the qualification cycle FROM 2023TO 2024**

1. Basic Course/Module Information

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| --- | --- |
| Course/Module title | Introduction to logic and set theory |
| Course/Module code \* |  |
| Faculty (name of the unit offering the field of study) | *College of Natural Sciences* |
| Name of the unit running the course | *Institute of Mathematics* |
| Field of study | Mathematics |
| Qualification level | First degree |
| Profile | *Academic* |
| Study mode | *Full-time* |
| Year and semester of studies | *1 Year, 1 semester* |
| Course type | *Basic* |
| Language of instruction | English |
| Coordinator | Ewa Rak, PhD |
| Course instructor | *Ewa Rak, PhD* |

\* - as agreed at the faculty

1.1.Learning format – number of hours and ECTS credits

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Semester  (n0.) | Lectures | Classes | Colloquia | Lab classes | Seminars | Practical classes | Internships | others | **ECTS credits** |
| 1 |  | 30 |  |  |  |  |  |  | 5 |

1.2. Course delivery methods

☒ conducted in a traditional way

☒ involving distance education methods and techniques

1.3. Course/Module assessment (exam, pass with a grade, pass without a grade)

Exam

2. Prerequisites

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| The knowledge of elementary mathematics on the level of secondary school. |

3. Objectives, Learning Outcomes, Course Content, and Instructional Methods

3.1. Course/Module objectives

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| --- | --- |
| O1 | Familiarization with the concepts of sentential and predicate calculus. |
| O2 | Familiarization with the concept of mathematical induction and its applications. |
| O3 | Introduction to basic concepts and facts in the field of sets and relations theory. |
| O4 | Presentation of the basic concepts concerning equivalence equations and orders. |

3.2. Course/Module Learning Outcomes (to be completed by the coordinator)

|  |  |  |
| --- | --- | --- |
| Learning Outcome | The description of the learning outcome  defined for the course/module | Relation to the degree programme outcomes |
| LO\_01 | Understanding the role and importance of proof in mathematics, as well as the concept of the importance of assumptions in the proof.  Knowledge of the concepts and methods of mathematical logic, set theory, relation calculus, and concepts concerning functions which are included in the fundamentals of various disciplines of mathematics. | KW\_01, K\_W02, K\_U01, K\_U02, K\_U03, K\_U04, K\_U23, K\_K02, K\_K05 |
| LO\_02 | Uses the propositional and predicate calculus; able to correctly use quantifiers also in everyday language.  Able in an understandable way (in speech and in writing) to provide the correct mathematical reasoning, formulate theorems and definitions.  Able to prove with the use of mathematical induction and to define functions and relations recursively. | K\_W04, K\_U05, |
| LO\_o3 | Uses the language of set theory, interpreting issues in different areas of mathematics.  Create new objects by constructing the quotient sets.  Understand the issues associated with different types of infinity and orders in sets. | K\_W03, K\_U06, K\_K05 |

**3.3. Course content (to be completed by the coordinator)**

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| Content outline |
| Propositional calculus.  Logical sentence. Chart of the propositional condition. Logical connectives. Tautologies. The rules of proof construction. |
| Predicate calculus.  Tautologies of the predicate calculus. Examples of applications of tautologies. |
| Set theory.  Sets. Operations on sets. Generalized operations on sets. |
| Natural numbers.  The Peano axioms. Mathematical Induction. Recursion. |
| Relation calculus.  The Cartesian product of sets. Relations. Operations on relations. Classification of relations. |
| Functions.  Property of functions. Images and inverse images of sets of functions. |
| Equivalence relations.  Equivalence relation. Class of abstraction and quotient set. The principle of abstraction. Constructions of sets with the use of equivalence relations. |
| Power of sets.  Finite and infinite sets. Equinumerosity of sets. Countable and uncountable sets. Cardinal numbers. |
| Orders in sets.  Partial order. Linear order. Types of linear orders. Kuratowski-Zorn's Lemma. The axiom of choice. |

3.4. Methods of Instruction

e.g.

*Lecture: a problem-solving lecture/a lecture supported by a multimedia presentation/ distance learning*

*Classes: text analysis and discussion/project work (research project, implementation project, practical project)/ group work (problem solving, case study, discussion)/didactic games/ distance learning*

*Laboratory classes: designing and conducting experiments*

Classes: working in groups and individual - task solving and proving theorems.

4. Assessment techniques and criteria

4.1 Methods of evaluating learning outcomes

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| --- | --- | --- |
| Learning outcome | Methods of assessment of learning outcomes (e.g. test, oral exam, written exam, project, report, observation during classes) | Learning format (lectures, classes,…) |
| LO-01 | oral exam | class |
| LO-02 | project, observation during classes | class |
| LO-03 | oral exam, discussion | class |

4.2 Course assessment criteria

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| students are Assessed regularly solving tasks writing.  The examination of students' knowledge in the oral form.  Grading score:  3.0 for 50 - 60%, 3.5 for 61 - 70 %, 4.0 for 71 – 80%, 4.5 for 81 – 90%; 5.0 for 91 – 100 % |

5. Total student workload needed to achieve the intended learning outcomes

– number of hours and ECTS credits

|  |  |
| --- | --- |
| Activity | Number of hours |
| Scheduled course contact hours | 30 |
| Non-contact hours - student's own work (preparation for classes or examinations, projects, etc.) | 70 |
| Total number of hours | 100 |
| Total number of ECTS credits | 5 ECTS |

\* One ECTS point corresponds to 25-30 hours of total student workload

6. Internships related to the course/module

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| --- | --- |
| Number of hours |  |
| Internship regulations and procedures |  |

7. Instructional materials

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| Compulsory literature:  U. Daepp, P. Gorkin, Reading, Writing, and Proving. A Closer Look at Mathematics (Undergraduate Texts in Mathematics), Springer, Bucknell University, 2011. |
| Complementary literature:  J. Słupecki, L. Borkowski, Elements of Mathematical Logic and Set Theory, Pergamon Press, PWN-Polish Scientific Publishers, Warszawa, 1967. |

Approved by the Head of the Department or an authorised person