Course Syllabus

I. General Information

Course name	Introduction to mathematics
Programme	Mathematics
Level of studies (BA, BSc, MA, MSc, long-cycle MA)	BA
Form of studies (full-time, part-time)	Full-time
Discipline	Mathematics
Language of instruction	English

Course coordinator/person responsible	Dr hab. Dariusz Partyka Dr Andrzej Michalski

Type of class *(use only the types mentioned below)*	Number of teaching hours	Semester	ECTS Points
lecture	60	1	10
tutorial			
classes	60	1	
laboratory classes			
workshops			
seminar			
introductory seminar			
foreign language classes			
practical placement			
field work			
diploma laboratory			
translation classes			
study visit			

Course pre-requisites	No introductory requirements.

II. Course Objectives

C1. Presentation of basic concepts of mathematical logic.
C2. Presentation of basic concepts of set theory.
C3. Familiarize students with basic number structures.

III. Course learning outcomes with reference to programme learning outcomes

Symbol	Description of course learning outcome	Reference to programme learning outcome
KNOWLEDGE		
W_01	The student knows how to construct and value logical formulas and quantifiers formulas. Is familiar with verification methods of logical tautologies. Understands what is an axiomatic system and what is the proving process. Knows basic axiomatic systems of sentential calculus.	K_W02, K_W03, K_W04, K_W05, K_W06
W_02	The student knows basic notions of the set theory and their properties. Understands what is an ordered pair and a relation. Distinguishes fundamental types of relations: Functions, order relations and equivalence relations. Knows their basic properties and examples.	K_W01, K_W04, K_W05, K_W06
W_03	The student knows what are equinumerous classes and what is the cardinality of a class. Is familiar with cardinal numbers, the operations on cardinal numbers and the order relation for cardinal numbers.	K_W04, K_W05, K_W06
W_04	The student is familiar with natural numbers. Knows the proving method by mathematical induction and the technique of defining functions by recurrence.	K_W02, K_W04, K_W05
W_05	The student knows how to construct the structures of integer, rational and real numbers.	K_W01, K_W03, K_W04
SKILLS		
U_01	The student can construct and value logical formulas and quantifiers formulas. Is capable to prove logical tautologies and derive consequences from axiomatic systems of sentential calculus and quantifier calculus. Uses logical tautologies, in particular can find a normal form of a logical formula.	K_U01, K_U02, K_U04, K_U36
U_02	The student can do the standard set operations and derive their basic properties. Is capable to analyze the properties of relations and functions. Uses order relations and equivalence relations. Constructs quotient classes of an equivalence relation.	K_U02, K_U04, K_U05, K_U06, K_U07, K_U09, K_U11, K_U36
U_03	The student is able to study the equinumerosity of classes, to do arithmetic operations on cardinal numbers and to compare cardinal numbers.	K_U02, K_U05, K_U06, K_U07
U_04	The student can prove properties involving natural numbers by means of mathematical induction and can construct functions by the recurrence technique	K_U01, K_U02, K_U03, K_U06, K_U09, K_U11
U_05	The student uses the properties of arithmetical operations and order relation for integral numbers, rational numbers and real numbers.	K_U02, K_U04, K_U05, K_U06, K_U08, K_U09, K_U11
SOCIAL COMPETENCIES		
K_01	The student understands the need to further develop his knowledge and skills in basic of mathematics. Can formulate questions in order to better understand the subject.	K_K01

K_02	The student can present issues dealing with basic of mathematics in an understandable way.	K_K05

IV. Course Content

1. Logical sentences and logical formulas. Logical tautologies.
2. Logical functions and quantifiers formulas. Quantifiers tautologies.
3. The mathematical logic as a description language of mathematics.
4. Axiomatic systems. Mathematical deduction.
5. Classes of objects.
6. Basic operations on classes.
7. Ordered pairs. Cartesian product of classes. Relations. Structures.
8. Zermelo–Fraenkel set theory with the axiom of choice (ZFC structures).
9. Functions and types of functions.
10. Order relations. The greatest element, the least element, a maximal element, a minimal element of a class. The supremum and infimum of a class.
11. Equivalence relations. Abstract classes and quotient classes.
12. The equinumerosity of classes. Cardinal numbers. Operations on cardinal numbers. The order relation of cardinal numbers.
13. Natural numbers. Mathematical induction. Defining functions by recurrence. Sequences and finite sequences. Generalized sequences.
14. The Peano axioms for the natural numbers.
15. The structure of integers.
16. The structure of rational numbers.
17. The structure of real numbers.
18. The extended structure of real numbers.

V. Didactic methods used and forms of assessment of learning outcomes

Symbol	Didactic methods *(choose from the list)*	Forms of assessment *(choose from the list)*	Documentation type *(choose from the list)*
KNOWLEDGE			
W_01	Conventional lecture.	Exam, oral test.	Written test.
W_02	Conventional lecture.	Exam, oral test.	Written test.
W_03	Conventional lecture.	Exam, oral test.	Written test.
W_04	Conventional lecture.	Exam, oral test.	Written test.
W_05	Conventional lecture.	Exam, oral test.	Written test.
SKILLS			
U_01	Practical classes.	Test.	Evaluated test.
U_02	Practical classes.	Test.	Evaluated test.
U_03	Practical classes.	Test.	Evaluated test.
U_04	Practical classes.	Test.	Evaluated test.
U_05	Practical classes.	Test.	Evaluated test.
SOCIAL COMPETENCIES			
K_01	Discussion.	Observation.	Rating card.
K_02	Discussion.	Observation.	Rating card.

VI. Grading criteria, weighting factors.....

LECTURE:
The completion of classes is required.
Written and oral exam together constitute the final grade:
91 – 100% (5,0)
81 – 90% (4,5)
71 – 80% (4,0)
61 – 70% (3,5)
51 – 60% (3,0)
0 – 50% (2,0)

CLASSES:
At least 80% of attendance is required.
Three tests together constitute the final grade:
91 – 100% (5,0)
81 – 90% (4,5)
71 – 80% (4,0)
61 – 70% (3,5)
51 – 60% (3,0)
0 – 50% (2,0)

Detailed rules of evaluation are given on lectures and classes.

VII. Student workload

Form of activity	Number of hours
Number of contact hours (with the teacher)	180
Number of hours of individual student work	150

VIII. Literature

Basic literature
Lecture notes and lecture notes in electronic form as well as 1. R. R. Stoll, *Set Theory and Logic*, Dover Publications, Inc., New York. 2. K. Kuratowski, *Wstęp do teorii mnogości i topologii*, PWN, Warszawa. 3. H. Rasiowa, *Wstęp do matematyki współczesnej*, PWN, Warszawa. 4. J. Onyszkiewicz, W. Marek, *Elementy logiki i teorii mnogości w zadaniach*, PWN, Warszawa. 5. A. Rutkowski, *Elementy logiki matematycznej*, Wyd. Szkolne i Pedagogiczne, Warszawa. 6. W. Guzicki, P. Zakrzewski, *Wykłady ze wstępu do matematyki*, wprowadzenie do teorii mnogości, PWN, Warszawa. 7. W. Guzicki, P. Zakrzewski, *Wstęp do matematyki*, zbiór zadań, PWN, Warszawa.
Additional literature
1. M.L. O'Leary, *A First Course in Mathematical Logic and Set Theory*, Wiley. 2. C. C. Pinter, *A Book of Set Theory*, Dover Publications, Inc., Mineola, New York. 3. L. Borkowski, *Wprowadzenie do logiki i teorii mnogości*, Tow. Naukowe KUL, Lublin.

4. A. Grzegorczyk, *Zarys logiki matematycznej*, PWN, Warszawa.
5. I. A. Ławrow, Ł.L. Maksimowa, *Zadania z teorii mnogości, logiki matematycznej i teorii algorytmów*, PWN, Warszawa.
6. K. A. Ross, Ch. R. B. Wright, *Matematyka dyskretna*, Wyd. Naukowe PWN, Warszawa.
7. J. Słupecki, K. Hałkowska, K. Piróg-Rzepecka, *Logika matematyczna*, Wyd. Naukowe PWN, Warszawa.
8. B. Stanosz, *Wprowadzenie do logiki formalnej*, Wyd. Naukowe PWN, Warszawa.
9. B. Stanosz, *Ćwiczenia z logiki*, Wyd. Naukowe PWN, Warszawa.