GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Introduction to logic and set theory, PG_00021021		
Field of study	Mathematics		
Date of commencement of studies	October 2023	Academic year of realisation of subject	2023/2024
Education level	first-cycle studies	Subject group	Obligatory subject group in the field of study Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	1	ECTS credits	5.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Probability Theory and Biomathematics -> Faculty of Applied Physics and Mathematics		
Name and surname of lecturer (lecturers)	Subject supervisor	dr Joanna Cyman	
	Teachers	dr Joanna Cyman dr Maryna Shcholokova	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	30.0	0.0	0.0	0.0	60
	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	60	5.0	60.0	125

Subject objectives	Introduction of the basic concepts of basic mathematics necessary for further study of mathematical objects.

Learning outcomes

Course outcome	Subject outcome	Method of verification
K6_U02	Student can apply mathematical induction and strong (complete) mathematical induction in tasks. He can define recursive relationships and proves their correctness.	[SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools
K6_W02	Student knows the basic types of mathematical proofs and uses them properly. He can present classic proofs by contradiction, for example, proof that the square root of 2 is not rational or Euclid's theorem that asserts that there are infinitely many prime numbers.	[SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects
K6_U01	The student is able to present in an understandable way, in speech and writing, correct mathematical reasoning, can formulate theorems and definitions. He can establish equivalences between particular formulas. He knows and correctly applies the laws of quantifiers.	[SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools
K6_U03	Student knows the concept of cardinality of a set. He knows different types of infinity. He can prove that a given set is countable or show that it is not countable. He also knows the relations of partial and linear order in sets and correctly proves whether a given set is an orderly set.	[SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools
K6_W06	Student knows and can apply selected tautology and rules of set.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects

Subject contents

Propositional Calculus. Logical connectives. Tautologies. Square of opposition. Rules of inference. Methods of proof. Reasoning methods and argumentation.

Sets. Axiom of extensionality. Subsets. Basic operations. Cartesian product of sets. First order predicate calculus. Union and intersection family of sets. Field of sets. Axiomatic set theory.

Principle of Mathematical Induction and recurrence relation. Natural numbers. Principle of minimum. Various version of principle of mathematical induction. Examples of recursions.

Functions. Definition of a function. Examples of functions. Properties of functions. Operations on functions. Inverse function. Images and preimages.

Relations. Formal definitions. Operations on relations. Basic properties and kinds of relations. Equivalence relation. Partially ordered set. Well-ordered set. Totally ordered set.

The Cardinality of Sets. Comparing sets. Cardinalities of sets. CantorBernsteinSchroeder theorem. Countable and uncountable sets. Cardinality of the continuum. Continuum hypothesis.

Prerequisites and co-requisites

Knowledge of mathematics on the secondary school level.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Midterm colloquium	50.0%	54.0%
Written exam	50.0%	40.0%
Activity	30.0%	6.0%

Recommended reading

Basic literature

- H. Rasiowa " Wstęp do matematyki współczesnej"; Wydawnictwo Naukowe PWN, Warszawa, 2005.
- J. Topp "Wstęp do matematyki", Wydawnictwo Politechniki Gdańskiej; Wydawnictwo Politechniki Gdańskiej, Gdańsk 2009.
- K. Kuratowski "Wstęp do teorii mnogości i topologii";Wydawnictwo Naukowe PWN, Warszawa, 2004.

	Supplementary literature	• K. Ross, Ch. Wright "Matematyka dyskretna"; Wydawnictwo Naukowe PWN, Warszawa, 2006. • J. Kraszewski "Wstęp do matematyki"; WNT, Warszawa, 2009. • W. Guzicki, P. Zakrzewski "Wykłady ze wstępu do matematyki"; Wydawnictwo Naukowe PWN, Warszawa, 2005. • W. Guzicki, P. Zakrzewski "Wstęp do matematyki. Zbiór zadań"; Wydawnictwo Naukowe PWN, Warszawa, 2005. • W. Marek, J. Onyszkiewicz "Elementy logiki i teorii mnogości w zadaniach"; Wydawnictwo Naukowe PWN, Warszawa, 2006.
	eResources addresses	Adresy na platformie eNauczanie: Wstęp do logiki i teorii mnogości 2023/2024 - Moodle ID: 29124 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=29124
Example issues/ example questions/ tasks being completed	1. Express a sentence (\sim p\vee q)\Rightarrow \sim r with a) a Sheffer stroke; b) a Peirce's arrow. Write used tautologies. 2. Express propositional formula ((p\wedge q)\Rightarrow \sim r)\Rightarrow ((p\Rightarrow \sim r) \Rightarrow p in disjunctive normal form. 3. Determine the power set of A={\emptyset, 3, {emptyset, 3},{emptyset}. 4. Prove by induction that \forall_{n\in N, n\geq 2} \frac 1{n+1}+\frac 1{n+2}+\frac 1{n+3}+...+\frac 1{n+n} >\frac{13}{24}. 5. Prove by induction that for a natural number n \ geq 72, there are integers x and y such that n = 13x + 7y. 6. We define recursively a sequence (a_n) by: a_0=a_1=a_2=1 and a_n=a_{n-1}+a_{n-3} dla n\geq 3. Prove that a_n\geq 2a_{n-2} for all n\geq 3 and prove that a_n\geq (\sqrt 2)^{n-2} for all n\geq 2. 7. Given is a function f: A \ times A \ rightarrow A, where f (x, y) = 5x +7 y for x, y \in A. Examine whether f is injective function or surjective function, and then find f ({1,2,3 } \ times {3,7}) and f ^ {-1} ({0,7}), if: (a) a = N; (b) A = Z. 8. We assume that for numbers a, b \ in Z we have a R b if and only if 7 | (3a + 4b). Prove that R is an equivalence relation in the set Z. Determine the equivalence classes of numbers 0 and 1 9. Prove that the set of N-{0,2,7} has the same cardinality as the set N. 10. Prove that the line (-1; 1) has the same cardinality as the line (-1; 1>.	
Work placement	Not applicable	