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 2024		Academic year of realisation of subject		2024/2025	
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				
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	(see table below)

Course outcome	Subject outcome	Method of verification
K6_W06	Student knows and can apply selected tautology and rules of set.	[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge
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.	[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information
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.	[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information
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.	[SW3] Assessment of knowledge contained in written work and projects [SW2] Assessment of knowledge contained in presentation
K6_U02	Student can apply mathematical induction and strong (complete) mathematical induction in tasks. He can define recursive relationships and proves their correctness.	[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information

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
Activity	30.0%	6.0%
Written exam	50.0%	40.0%
Midterm colloquium	50.0%	54.0%

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:
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	