

Subject card

Subject name and code	Mathematical Analysis I, PG_00155379						
Field of study	Mathematics						
Date of commencement of studies	October 2025		Academic year of realisation of subject		2025/2026		
Education level	Bachelor's studies		Subject group		Obligatory subject group 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		11.0		
Learning profile	academic		Assessment form		exam		
Conducting unit	Institute of Mathematics -> Faculty of Mathematics, Physics and Informatics -> Rector						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Jacek Gulowski				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	60.0	60.0	0.0	0.0	0.0	120
	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	120		15.0		140.0	275
Subject objectives	The aim of the subject Mathematical Analysis I is to familiarize students with the basic concepts of the theory of real and function sequences and series, as well as concepts related to the continuity of real functions of one real variable.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[MATL3_U09] is able to plan how to solve a specific problem and prepare a correct record of this solution, providing strict and precise justification for the correctness of his reasoning	The student is able to formulate and prove simple theorems.	[SU4] test/exam - oral or written
	[MATL3_U07] is able to correctly use the acquired concepts of topology, is able - at a simple and medium level of difficulty - to apply the known theorems and methods of this field and is able to interpret the obtained results	The student is able to apply the methods of solving problems learned, correctly uses the concepts learned, is able to interpret the obtained results and solve practical problems related to the subject matter.	[SU3] text preparation/written work
	[MATL3_U03] is able to correctly use the acquired concepts of linear algebra and geometry, is able - at a simple and medium level of difficulty - to apply the known theorems and methods in these fields and is able to interpret the obtained results	The student is able to apply the methods of solving tasks learned, correctly uses the concepts learned, is able to interpret the obtained results and solve practical tasks related to the subject matter.	[SU3] text preparation/written work
	[MATL3_K01] is ready to accept the limitations of his/her own knowledge and understands the need for further education	The student is ready to understand his/her limitations and the need for further education	[SK8] observation of student's independent or team work
	[MATL3_W09] knows and understands the role and importance of proof in mathematics, as well as the concept of the importance of assumptions	The student knows and understands the basic theorems and proofs of theorems concerning the concepts of mathematical analysis, studied during the course, concerning functions of one variable defined on subsets of the real line	[SW4] test/exam - oral or written
	[MATL3_W01] knows and understands the basic concepts, methods and theorems of mathematical logic and set theory, as well as basic examples illustrating specific concepts in these fields and enabling the refutation erroneous hypotheses or unauthorized reasoning	The student knows and understands the definitions of: the limit and convergence of a number sequence, the convergence of a number series, the limit and pointwise and uniform convergence of function sequences and series, the limit of a function defined on a subset of a straight line, and the continuity of a function of one variable.	[SW4] test/exam - oral or written
	[MATL3_U08] is able to formulate definitions and theorems in an understandable way, both orally and in writing, and present correct mathematical reasoning regarding the acquired issues	The student is able to present correct mathematical reasoning in an understandable manner, both orally and in writing.	[SU4] test/exam - oral or written
	[MATL3_W02] knows and understands the basic concepts, methods and theorems of mathematical analysis as well as basic examples illustrating specific concepts in this field and enabling the refutation erroneous hypotheses or unauthorized reasoning	The student knows and understands the basic theorems and proofs of theorems concerning the concepts of mathematical analysis of functions of one variable defined on subsets of the real line	[SW4] test/exam - oral or written
	[MATL3_W08] knows and understands the structure of mathematical theories, is able to use mathematical formalism to build and analyze simple mathematical models in other fields of science	The student knows and understands the geometric and physical interpretations of mathematical analysis concepts.	[SW4] test/exam - oral or written
	[MATL3_W07] knows and understands selected concepts, methods and theorems of topology, as well as basic examples illustrating specific concepts in this field and enabling the refutation of erroneous hypotheses or unauthorized reasoning	The student knows and understands the definitions of: the limit and convergence of a number sequence, the convergence of a number series, the limit and pointwise and uniform convergence of function sequences and series, the limit of a function defined on a subset of a straight line, and the continuity of a function of one variable.	[SW4] test/exam - oral or written

	Course outcome	Subject outcome	Method of verification
	[MATL3_K09] is ready to critically evaluate arguments, find gaps in reasoning and constructively criticize other people's reasoning	The student is ready to critically evaluate arguments, find gaps in reasoning and constructively criticize the reasoning of others.	[SK1] oral statement/conversation/discussion
	[MATL3_U02] is able to correctly use the known concepts of mathematical analysis, is able - at a simple and medium level of difficulty - to apply the known theorems and methods of this field and is able to interpret the obtained results	The student is able to present correct mathematical reasoning in an understandable manner, both orally and in writing.	[SU3] text preparation/written work
	[MATL3_U01] is able to correctly use the known concepts of mathematical logic and set theory, is able - at a simple and medium level of difficulty - to apply the known theorems and methods of these fields and is able to interpret the obtained results	The student is able to formulate and prove simple theorems.	[SU3] text preparation/written work
	[MATL3_K06] is ready to formulate opinions on basic mathematical issues	The student is ready to formulate opinions on basic mathematical issues	[SK1] oral statement/conversation/discussion
	[MATL3_K04] is ready to understand and appreciate the importance of intellectual honesty in one's own and other people's actions; is willing to act ethically	The student is ready to understand and appreciate the importance of intellectual honesty	[SK8] observation of student's independent or team work
	[MATL3_W03] knows and understands the basic concepts, methods and theorems of linear algebra and analytical geometry, as well as basic examples both illustrating specific concepts in these fields and enabling the refutation of erroneous hypotheses or unauthorized reasoning	The student knows and understands the applications of functions of one variable in analytic geometry.	[SW4] test/exam - oral or written
Subject contents	1. Real numbers. Axiomatics of real numbers. Infimum and supremum. Sequences of real numbers. The concept of a sequence, monotonic sequences, bounded sequences. Limit of a sequence, theorem on the limits of sums, products and quotients of convergent sequences, squeeze theorem, limits of monotonic sequences. Cauchy's condition. Concentration points of a sequence, lower and upper limits. Improper limits. 2. Number series. Convergence and sum of a series, geometric series. Necessary condition for convergence of a series. Harmonic series. Basic criteria for convergence of a series with non-negative terms. Absolute, unconditional and conditional convergence. Criteria of Dirichlet, Abel and Leibniz. Multiplication of series. 3. Real functions of a real variable. Cauchy's and Heine's definition of the limit and continuity of a function. Uniform continuity. Properties of a continuous function on a closed interval. Improper limits. 4. Functional sequences and series. Pointwise convergence and uniform convergence of functional sequences and series. Cauchy's condition for uniform convergence. Theorem on the continuity of the limit (sum) of a uniformly convergent sequence (series). Weierstrass's criterion. Weierstrass's theorem on the approximation of continuous functions by polynomials. Power series, their radius and interval of convergence. 5. Propositional calculus and laws of quantifier calculus. Basic elements of set theory and topology.		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	tests and quizzes	51.0%	50.0%
	exam	51.0%	50.0%
	observation of the student's attitude	51.0%	0.0%

Recommended reading	Basic literature	A. Basic bibliography: A.1 used in classes K. Kuratowski "Rachunek różniczkowy i całkowy", PWN Warszawa 1973. K. Jankowska, T. Jankowski "Zbiór zadań z matematyki" Wydawnictwo Politechniki Gdańskiej 2003 K. Jankowska, T. Jankowski "Zadania z matematyki wyższej" Wydawnictwo Politechniki Gdańskiej 2011 J. Banaś, S. Wędrychowicz, Zbiór zadań z analizy matematycznej, Wydawnictwo Naukowo-Techniczne, Warszawa 2001. W. Marek, J. Onyszkiewicz "Elementy logiki i teorii mnogości w zadaniach", PWN Warszawa 1978 A.2 studiowana by a student W. Krywicki, L. Włodarski, Analiza matematyczna w zadaniach, część I i II, PWN Warszawa 1986.
	Supplementary literature	G.M. Fichtenholz, Rachunek różniczkowy i całkowy, tom I, II i III. PWN Warszawa 1978.
	eResources addresses	
	Example issues/ example questions/ tasks being completed	not included
Work placement	Not applicable	

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