

Subject card

Subject name and code	Mathematical Analysis II, PG_00155550						
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	2		ECTS credits		11.0		
Learning profile	academic		Assessment form		exam		
Conducting unit							
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Jacek Gulgowski				
	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 II is to familiarize students with the concepts, theorems and methods of differential and integral calculus of functions of one variable.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[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 knows and understands the geometric applications of differential and integral calculus of functions of one variable.	[SU3] text preparation/written work
	[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 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 mathematical analysis.	[SU3] text preparation/written work
	[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 knows and understands the definitions of open, closed and compact sets in Euclidean space and their properties.	[SU3] text preparation/written work
	[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 is able to present correct mathematical reasoning in an understandable manner, both orally and in writing.	[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 basic theorems and proofs of theorems concerning differential and integral calculus of functions of one variable defined on subsets of the real line	[SW4] test/exam - oral or written
	[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_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 problem of expanding a function into a power series or a trigonometric series.	[SW4] test/exam - oral or written
	[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 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 mathematical analysis.	[SU3] text preparation/written work
	[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 use concepts and theorems related to the convergence of functional sequences and series.	[SU3] text preparation/written work
	[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 examples illustrating the above-mentioned concepts of mathematical analysis.	[SW4] test/exam - oral or written
	[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

	Course outcome	Subject outcome	Method of verification
	[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 differential calculus of functions of one variable in analytic geometry and the construction of the Riemann integral from a bounded function and the properties and interpretations of this concept	[SW4] test/exam - oral or written
	[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_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 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 acknowledge the limitations of his/her own knowledge and is ready 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 above-mentioned concepts of mathematical analysis of functions of one variable defined on subsets of the real line	[SW4] test/exam - oral or written
Subject contents	- Derivative of a function of one variable. Derivative, its geometric meaning. Derivatives of elementary functions. Derivative of a sum, product, quotient and superposition of functions, derivative of an inverse function. Rolle, Lagrange and Cauchy theorems. Higher order derivatives, functions of class C^n. Taylor's formula. Necessary and sufficient conditions for the existence of a local extremum. Applications of differential calculus to curve sketching (sketching graph of the function). De l'Hopital's rule. - Riemann integral of a function of one variable. Construction of the Riemann integral and its basic properties. Integrability of a continuous function. Integral estimates, integral mean value theorems. Indefinite integral (the concept of an antiderivative). Fundamental theorem of integral calculus. Integration by parts and by substitution. - 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. Definition of elementary functions using power series. Integration of functional sequences and series. Fourier series. Basic properties of Fourier series. - Euclidean metric in R^d spaces, convergence of sequences in R^d. Continuity and differentiability of R^d-valued functions of one variable (vector functions). Tangent to a curve. Properties of norm and scalar product. Open and closed sets, compact sets in Euclidean spaces. Limits and continuity of vector-valued functions of several variables.		
Prerequisites and co-requisites	Convergence of number sequences and series. Continuity of real functions of one real variable. Pointwise and uniform convergence of function sequences and series.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	tests	51.0%	50.0%
	final exam	51.0%	50.0%
	student's attitude evaluation	51.0%	0.0%
Recommended reading	Basic literature	W. Rudin, <i>Podstawy analizy matematycznej</i>, Państwowe Wydawnictwo Naukowe, Warszawa 1982. K. Kuratowski, <i>Rachunek różniczkowy i całkowy</i>, PWN Warszawa 1973. A. Birkholc: <i>Analiza matematyczna. Funkcje wielu zmiennych</i>. PWN W-wa, 1995. J. Banaś, S. Wędrychowicz, <i>Zbiór zadań z analizy matematycznej</i>, Wydawnictwo Naukowo-Techniczne, Warszawa 2001. W. Kaczor, M. Nowak, <i>Zadania z analizy matematycznej</i>, t2, PWN 2 W. Kaczor, M. Nowak, <i>Zadania z analizy matematycznej</i>, t3, PWN :	

	Supplementary literature	• G.M. Fichtenholz, <i>Rachunek różniczkowy i całkowy</i>, tom I, II i III. Państwowe Wydawnictwo Naukowe, Warszawa 1978. • W. Krywicki, L. Włodarski, <i>Analiza matematyczna w zadaniach</i>, część I i II, Państwowe Wydawnictwo Naukowe, Warszawa 1986. • Ryszard Rudnicki, <i>Wykłady z analizy matematycznej</i>, PWN, Warszawa 2012
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Example issues/ example questions/ tasks being completed	N/A	
Work placement	Not applicable	

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