Subject card

Subject name and code	Mathematical Analysis II, PG_00155247					
Field of study	Mathematical Modeling and Data Analysis					
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		9.0	
Learning profile	academic		Assessment form		exam	
Conducting unit						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. Barbara Wolnik			
	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	90.0	225
Subject objectives	The aim of the course is to familiarize students with the concepts, theorems and methods of integral calculus of functions of one variable and the theory of functional sequences and series.					

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[MMiADL3_U02] correctly uses the concepts of mathematical analysis, is able - on a simple and medium level of difficulty - to apply the learned theorems and methods in this field, and is able to interpret the results obtained	The student correctly uses the concepts and the methods of mathematical analysis learned during the course.	[SU4] test/exam - oral or written
	[MMiADL3_K09] is ready to critically evaluate arguments, find gaps in reasoning, and constructively criticise other people's reasoning	The student is ready to critically evaluate arguments, find gaps in reasoning and constructively criticize the raesoning of others within the scope of the material covered during the course.	[SK8] observation of student's independent or team work
	[MMiADL3_U06] correctly uses the learned concepts of topology	The student correctly uses the concepts of topology learned during the course.	[SU4] test/exam - oral or written
	[MMiADL3_U08] is able to plan a way to solve a given problem and make a correct record of this solution, providing accurate and precise justifications for the correctness of their reasoning	The student is able to solve problems in the scope of the material realized during the course.	[SU4] test/exam - oral or written
	[MMiADL3_K01] is ready to accept the limitations of his/her own knowledge and understands the need for further education	The student knows the limitations of his own knowledge in mathematical analysis and is ready for further education.	[SK8] observation of student's independent or team work
	[MMiADL3_W01] knows the basic concepts, methods and theorems of mathematical logic and set theory	The student knows the basic concepts and selected methods and theorems of mathematical logic and the set theory in the scope of the material realized during the course.	[SW4] test/exam - oral or written
	[MMiADL3_W06] knows the selected concepts, methods and theorems of topology	The student knows the basic concepts and selected methods and theorems of topology in terms of the material discussed during the course.	[SW4] test/exam - oral or written
	[MMiADL3_K02] is ready to precisely formulate questions to deepen his/her own understanding of a given topic or to find missing elements of reasoning	The student is ready to formulate precise questions that serve to deepen one's own understanding of a given topic or to find missing elements of reasoning in the scope of the material covered during the course.	[SK8] observation of student's independent or team work
	[MMiADL3_U01] correctly uses the learned concepts of mathematical logic and set theory	The student correctly uses the concepts of mathematical logic and set theory learned during the course.	[SU4] test/exam - oral or written
	[MMiADL3_W08] knows and understands well the role and importance of proof in mathematics, as well as the concept of the significance of assumptions	The student understands the theorems learned during the course.	[SW4] test/exam - oral or written
	[MMiADL3_W02] knows the basic concepts, methods and theorems of mathematical analysis, and basic examples both illustrating specific concepts in this field, and allowing to refute incorrect hypotheses or unauthorized reasoning	The student knows the basic concepts and selected methods and theorems ofmathematical analysis in terms of the material discussed during the course.	[SW4] test/exam - oral or written
	[MMiADL3_U07] can comprehensively, in speech and in writing, formulate definitions and theorems and present correct mathematical reasoning regarding the issues learned	The student is able to present correct mathematical reasoning in an understandable manner, both orally and in writting.	[SU4] test/exam - oral or written
	[MMiADL3_K04] is ready to understand and appreciate the importance of intellectual honesty in own and other people's actions; is ready 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

	<table><tr><th>Course outcome</th><th>Subject outcome</th><th>Method of verification</th></tr><tr><td>[MMiADL3_W07] knows and understands the construction of mathematical theories, can use mathematical formalism to build and analyse simple mathematical models in other fields of science</td><td>The student correctly understands the concepts and the methods of mathematical analysis learned during the course.</td><td>[SW4] test/exam - oral or written</td></tr><tr><td>[MMiADL3_K06] is ready to formulate opinions on basic mathematical issues</td><td>The student is ready to formulate an opinion on basic mathematical issues within the scope of the material covered during the course.</td><td>[SK8] observation of student's independent or team work</td></tr></table>
Subject contents	1. Indefinite integral (the concept of an antiderivative) and basic methods of its calculation. Definite integral of a continuous function. Construction of the Riemann integral and its basic properties. Improper integrals. Integral estimates, integral mean value theorems. Basic theorems of integral calculus. 2. 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. 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.
Prerequisites and co-requisites	**none**
Assessment methods and criteria	<table><tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr><tr><td>not applicable</td><td>51.0%</td><td>50.0%</td></tr><tr><td>not applicable</td><td>51.0%</td><td>50.0%</td></tr><tr><td>not applicable</td><td>100.0%</td><td>0.0%</td></tr></table>
Recommended reading	<table><tr><td>Basic literature</td><td>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</td></tr><tr><td>Supplementary literature</td><td>W. Krysicki, L. Włodarski, Analiza matematyczna w zadaniach, część I i II, PWN Warszawa 1986. G.M. Fichtenholz, Rachunek różniczkowy i całkowy, tom I, II i III. PWN Warszawa 1978.</td></tr><tr><td>eResources addresses</td><td></td></tr></table>

Example issues/ example questions/ tasks being completed	Discuss the formula for integration by substitution: formulate and prove the appropriate theorem and solve the given example. Give the definition of a proper rational function. Formulate the theorem on the decomposition of a proper rational function into simple fractions. Explain (using examples) the methods of calculating coefficients. Formulate the definition of a Riemann-integrable function on the interval [a,b]. Explain the concept using illustrative examples. Formulate the Cauchy-Maclaurin theorem (on the relationship between the convergence of an improper integral and the convergence of the appropriate series). Discuss its proof, indicating the significance of the individual assumptions. Give any of the necessary and sufficient conditions for uniform convergence of a functional sequence that you have learned. Discuss the issue using selected examples. Discuss the properties of power series that you have learned (concerning sum, uniform convergence, equality of two series, integration and differentiation term by term). Derive the formula called binomial series.
Work placement	Not applicable