University of Gdańsk

Subject card

Subject name and code	Advanced Mathematical Analysis, PG_00207081		
Field of study	Mathematical Modeling and Data Analysis		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2026/2027
Education level	Master's 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	7.0
Learning profile	academic	Assessment form	exam
Conducting unit	Division of Real Functions -> Institute of Mathematics -> Faculty of Mathematics, Physics and Informatics -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	dr Jacek Tryba	
	Teachers	dr Jacek Tryba	

Lesson types

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	110.0	175

Subject objectives

To familiarize students with the concepts, theorems and methods of measure and Lebesgue integral theory.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[MMiADM2_U01] is able to construct mathematical reasoning: prove theorems, formulate, test and refute hypotheses by constructing and selecting counterexamples, choosing, if necessary, methods and tools from various branches of mathematics and related sciences	The student is able to use the studied concepts, formulate and prove their properties, present correct mathematical reasoning, apply learned methods in order to solve exercises related to the subject.	[SU4] test/exam - oral or written
[MMiADM2_W01] knows and understands in depth the theory of selected areas of mathematics, the complex relationships between them and their development trends	The student knows and understands the concepts of measure theory and their connections with other branches of mathematical analysis and probability.	[SW4] test/exam - oral or written
[MMiADM2_W02] knows and understands in depth the role and importance of the construction of mathematical reasoning	The student knows and understands the concept of measure, measurable function, the construction of Lebesgue measure in Euclidean spaces; the construction of Lebesgue integral.	[SW4] test/exam - oral or written

Subject contents	1. Fields and sigma-fields of sets. Borel sets. 2. Measure and its construction via outer measure. Theorem of Caratheodory. 3. Lebesgue measure in R^k. Properties of measurable sets. 4. Measurable functions and their properties. 5. The construction of Lebesgue integral. Properties of integrable functions.Convergence theorems. 6. Fubini Theorem. Theorem on changing variables.
Prerequisites and co-requisites	

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
written/oral exam	51.0%	50.0%
colloquia	51.0%	50.0%

Recommended reading

Basic literature	1. A. Birkholc, Analiza matematyczna. Funkcje wielu zmiennych. PWN Warsaw, 1995. 2. M. Balcerzak, Wykłady z teorii miary. Lodz University of Technology Publishing House, 2011. 3. P. Halmos, Measure Theory. Springer, 1974. 4. L. Górniewicz, R. Ingarden, Analiza matematyczna dla fizyków. UMK Publishing House, Toruń 1996. 5. W. Kaczor, M. Nowak, Zadania z Analizy Matematycznej. Całkowanie. PWN 2006.
Supplementary literature	1. P. Billingsley, Probability and Measure, Wiley-Interscience, 1995
eResources addresses	

Example issues/ example questions/ tasks being completed	1. Find all measurable sets with respect to a fixed outer measure. 2. Prove the measurability of a given function. 3. Present the construction of the Lebesgue measure in R^k. 4. Present the construction of the Lebesgue integral. 5. Examine the integrability of a given function. Calculate the integral. 6. Formulate and prove Lebesgue's theorem on monotone convergence (Fatou's lemma, Lebesgue's theorem on bounded convergence).
Work placement	Not applicable