University of Gdańsk

Subject card

Subject name and code	Advanced Mathematical Analysis, PG_00206846		
Field of study	Mathematics		
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	9.0
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	prof. dr hab. Tomasz Natkaniec	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	45.0	45.0	0.0	0.0	0.0	90

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	90	6.0	129.0	225

Subject objectives

To introduce students to the concepts, theorems and methods of advanced measure and integral theory.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[MATMU2_W01] knows and understands in depth the theory of selected areas of mathematics or related fields, the complex relationships between them and their development trends	The student knows and understand the basic concepts of abstract measure and integral theory.	[SW4] test/exam - oral or written
[MATMU2_W02] knows and understands in depth the role and importance of the construction of mathematical reasoning	The student knows and understands the basic concepts of abstract measure and integral theory, such as: various types of convergence of sequences of measurable functions, including convergence by a measure; the concept of absolute continuity of measures; the concept of the product of measure spaces and the product measure.	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion
[MATMU2_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 areas of mathematics	The student is able to present correct mathematical reasoning in an understandable way in speech and writing, formulate and prove simple theorems, apply learned methods of solving tasks, correctly uses learned concepts, is able to interpret obtained results and solve practical tasks from the subject matter.	[SU1] oral statement/conversation/ discussion [SU4] test/exam - oral or written [SU8] observation of student's independent or team work

Subject contents	1. Measurable spaces, sigma-fields of sets, monotone classes. 2. Measurable functions. Different types of convergence of sequences of measurable functions, convergence in measure, Egoroff's Theorem. 3. Sigma-additive functions of sets. Hahn and Jordan decompositions. 4. Absolute continuity of measures. Randon-Nikodym Theorem.. Lebesgue decomposition. 5. Product measures. Fubini's Theorem.
Prerequisites and co-requisites	Knowledge of the theory of Lebesgue measure and Lebesgue integral within the scope of the subject Introduction to Measure Theory.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
tests	51.0%	45.0%
oral/written exam	51.0%	50.0%
observation of the student's attitude	51.0%	0.0%
activity	51.0%	5.0%

Recommended reading

Basic literature	1. R. Sikorski, Real Functions, PWN 1958. 2. P. Halmos, Measure Theory, Springer 1974. 3. W. Rudin, Real and Complex Analysis, PWN 2009.
Supplementary literature	1. A. Bruckner, J. Bruckner, B. Thomson, *Real Analysis*, Prentice-Hall International, 1997.
eResources addresses	

Example issues/ example questions/ tasks being completed	1. Giving the definition of convergence in measure. 2. Checking whether a given sequence converges in measure. 3. Formulating and proving Egoroff's Theorem. 4. Formulating and proving Fubini's Theorem. 5. Formulating and proving Radon-NikodymTheorem.
Work placement	Not applicable