University of Gdańsk

Subject card

Subject name and code	Advanced Mathematical Analysis, PG_00152914		
Field of study	Mathematics		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2024/2025
Education level	Master'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	6.0
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	prof. dr hab. Tomasz Natkaniec	

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	10.0	80.0	150

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_K05] is ready to independently search for information in literature, also in foreign languages	The student is ready to independently search for information in the literature, including in foreign languages.	[SK1] oral statement/conversation/ discussion [SK8] observation of student's independent or team work
[MATMU2_U01] can construct mathematical reasoning: prove theorems and refute hypotheses through construction and selection of counterexamples	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
[MATMU2_K01] is willing to acknowledge the limitations of his or her own knowledge and is willing to pursue further education	The student understands the limitations of his knowledge and is ready for further education.	[SK1] oral statement/conversation/ discussion [SK8] observation of student's independent or team work
[MATMU2_K02] is ready to precisely formulate questions to deepen his/her understanding of a given topic or find missing elements of reasoning	The student is able to precisely formulate questions from the field of advanced mathematical analysis.	[SK1] oral statement/conversation/ discussion [SK8] observation of student's independent or team work
[MATMU2_W01] knows and understands in-depth the theory of selected areas of mathematics	The student knows and understand the basic concepts of abstract measure and integral theory.	[SW4] test/exam - oral or written
[MATMU2_K04] is ready to understand and appreciate the importance of intellectual honesty in one's own and other people's actions; ethical conduct	The student appreciates the importance of intellectual honesty and ethical conduct.	[SK1] oral statement/conversation/ discussion [SK8] observation of student's independent or team work
[MATMU2_W02] knows and understands well 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_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 [SK8] 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 mmeasures. Randon-Nikodym Theorem.

5. Product measures. Fubini 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
	activity	0.0%	5.0%
	observation of student's attitude	100.0%	0.0%
	oral/written exam	50.0%	50.0%
	colloquia	50.0%	45.0%
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 by measure. 3. Formulating and proving Egoroff Theorem.		
Work placement	Not applicable		

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