



## Subject card

Subject name and code	Functional analysis II, PG_00021034						
Field of study	Mathematics						
Date of commencement of studies	October 2022	Academic year of realisation of subject			2022/2023		
Education level	second-cycle 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	2	ECTS credits			6.0		
Learning profile	general academic profile	Assessment form			exam		
Conducting unit	Department of Probability Theory and Biomathematics -> Faculty of Applied Physics and Mathematics						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. Zdzisław Dzedzej					
	Teachers	dr hab. Zdzisław Dzedzej dr inż. Robert Krawczyk					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	45.0	30.0	0.0	0.0	0.0	75
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	75	5.0		70.0		150
Subject objectives	Introduction to advanced topics of functional analysis and noncommutative normed algebras.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	K7_U06	Has a profound knowledge of topological linear spaces.			[SU2] Assessment of ability to analyse information		
	K7_W03	Explains the role of the set theory and von Neumann algebras in modern analysis.			[SW1] Assessment of factual knowledge		
	K7_U09	Synthesis measure theory, functional analysis and noncommutative algebras.			[SU4] Assessment of ability to use methods and tools		
K7_W02	Constructs models based on specific normed spaces.			[SW1] Assessment of factual knowledge			
Subject contents	Introduction to notation, basic definitions and revision of selected topics on set theory. Classical Banach spaces. The axiom of choice, Kuratowski - Zorn lemma, Hahn - Banach theorem. Characterization of compactness in specific Banach spaces. Stone - Weierstrass theorem. Dual operations. Weak and *weak topologies. Banach - Alaoglu theorem. Reflexivity. Banach algebras. Gelfand transform. C*-algebras. Spectral theorem and spectral measures. Strong and weak operator topologies. Basics of von Neumann algebras.						
Prerequisites and co-requisites	Courses completed: Functional Analysis I (MAT1016)						
Assessment methods and criteria	Subject passing criteria	Passing threshold			Percentage of the final grade		
	Activity/quizzes	51.0%			10.0%		
	Exam	51.0%			50.0%		
	Projects	51.0%			40.0%		

Recommended reading	Basic literature	<p>W.Rudin, Analiza funkcjonalna, PWN, 2001.</p> <p>J.Musielak, Wstęp do analizy funkcjonalnej, PWN, 1989.</p> <p>J.Górniak, T.Pytlik, Analiza funkcjonalna w zadaniach, Wyd. PWr, 1992.</p> <p>K.Zhu, An Introduction to Operator Algebras, CRC Press, 2000.</p>
	Supplementary literature	<p>R.V.Kadison, J.R.Ringrose, Fundamentals of the Theory of Operator Algebras, vol. I, III, AMS, 1997.</p> <p>F.Albiac, N.J.Kalton, Topics in Banach Space Theory, Springer, 2006.</p> <p>S.Prus, A.Stachura, Analiza funkcjonalna w zadaniach, PWN, 2007.</p>
	eResources addresses	<p>Adresy na platformie eNauczanie:</p> <p>Analiza funkcjonalna II 2023 - Moodle ID: 28237</p> <p><a href="https://enauczanie.pg.edu.pl/moodle/course/view.php?id=28237">https://enauczanie.pg.edu.pl/moodle/course/view.php?id=28237</a></p>
Example issues/ example questions/ tasks being completed	<p>Identify dual spaces. Investigate compactness of subsets of continuous functions on compact spaces. Find closures of specific subsets of Banach spaces. Investigate metrizable of weak and <math>^*</math>weak topologies. Investigate whether specific algebras are Banach algebras, <math>C^*</math>-algebras. Compare different operator topologies.</p>	
Work placement	<p>Not applicable</p>	