Subject card

Subject name and code	Functional analysis I , PG_00027634
Field of study	Mathematics

Date of commencement of studies	October 2026	Academic year of realisation of subject	2028/2029
Education level	first-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	blended-learning
Year of study	3	Language of instruction	Polish
Semester of study	5	ECTS credits	5.0
Learning profile	general academic profile	Assessment form	assessment

Conducting unit	Department of Nonlinear Analysis and Statistics -> Faculty of Applied Physics and Mathematics -> Faculties of Gdańsk University of Technology

Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Tomasz Szarek
	Teachers	

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: 28.0						

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	60.0	125

Subject objectives	Basic knowledge of the subject

Learning outcomes	Course outcome	Subject outcome	Method of verification
	K6_K01	knows limits of his knowledge and needs for further education. Is able to search for required information in literature.	[SK2] Assessment of progress of work
	K6_U04	Is fluent in calculus. Is able to apply the definitions of limits and different concepts of convergence. Is able in dealing with the convergence of series.	[SU1] Assessment of task fulfilment
	K6_U08	knows basic concepts of linear algebra: vectors, linear transformations, matrices. Is able to determine basic algebraic structures in mathematics. Can count determinant and knows its basic properties. Is able to provide geometric interpretation of determinant and knows its connection to mathematical analysis.	[SU1] Assessment of task fulfilment
	K6_U09	Is able to interpret systems of equations, is fluent in applying objects as vector field, phase spaces, is able to define and apply in practice basic topological properties of topological subspaces and measurable functions	[SU1] Assessment of task fulfilment
	K6_W01	Is aware of the importance of mathematics	[SW3] Assessment of knowledge contained in written work and projects

Subject contents	Course content – lecture Basic notions of linear algebra (repetition) Basic notions from metric topology (repetition). Normed linear spaces. Banach spaces. Unitary and Hilbert spaces. Linear operators in normed spaces, continuity and boundedness. The space of linear operators. Linear functionals, adjoint space. Riesz theorem, Hahn - Banach theorem. Open mapping, inverse mapping theorems, and closed graph theorem. Orthogonal projections in Hilbert spaces. Orthonormal bases in Hilbert spaces, Bessel inequality. Spectrum and resolvent of a bounded operator in a Banach space. Excercises: Practical training associated with the lecture material, applications		
Prerequisites and co-requisites	Analysis I,II,III Linear algebra		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Written exam	50.0%	25.0%
	Midterm colloquium	50.0%	75.0%
Recommended reading	Basic literature	J. Musielak, Introduction to Functional Analysis, PWN 1976 J. Rusinek, Problems in functional analysis, W UKSW 2006	
	Supplementary literature	Gerald Teschl: Functional Analysis, http://www.univie.ac.at/~gerald/	
	eResources addresses		
Example issues/ example questions/ tasks being completed			
Practical activites within the subject	Not applicable		

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