GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Real and coplex analysis , PG_00021033						
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	1			ECTS credits		5.0	
Learning profile	general academic profile			Assessment form		exam	
Conducting unit	Department of Nonlinear Analysis and Statistics -> Faculty of Applied Physics and Mathematics						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Marcin Styborski				
	Teachers		dr inż. Marcin Styborski				
Lesson types and methods of instruction	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	60.0		125
Subject objectives	The aim of the course is to supplement the knowledge of real and complex analysis of topics that are not processed during the three-semester course of calculus and the course of complex functions at the undergraduate level. These are also topics with which students are already familiar (convergence of sequences of function, differentiation and integration of functional sequences, change the order of limits).						

Learning outcomes

Course outcome	Subject outcome	Method of verification
K7_U03	Student independently formulate assertions and verifies the importance of assumptions and their significance in the proof.	[SU3] Assessment of ability to use knowledge gained from the subject
K7_W02	The student understands the importance of abstract theories and mathematical structures in resolving the issues formulated in engineering sciences (convergence of Fourier series, limit process in probability).	[SW1] Assessment of factual knowledge
K7_U02	The student is able to verify proofs based on rule of inference and consciously uses elementary methods and reasoning.	[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject
K7_U09	The student uses the methods of functional analysis and topology in the formulation of theses in the field of mathematical analysis.	[SU4] Assessment of ability to use methods and tools
K7_W01	The student is familiar with - Theorems about integration of functional sequences - Proof of the existence of a continuous function without derivative and topological properties of the set of such functions - Proof of the theorem about the divergence of Fourier series of continuous functions	[SW1] Assessment of factual knowledge

Subject contents	1. Sequences and series of functions. Convergence. 2. The criteria for uniform convergence: Dini, Weierstrass, Dirichlet 3. Arzeli lemma and theorem of bounded convergence for the Riemann integral 4. Applications of the theoremof bounded convergence. The dominated convergence theorem for the improper Riemann integral. 5. Continuous function without derivative. 6. Baire theorem. The set of functions without derivative in Banach spaces of continuous functions 7. Arzeli-Ascoli and Weierstrass theorems. Stone's theorem and its consequences 8. Fourier series: the Riemann-Lebesgue Lemma, pointwise convergence, the principle of localization, Dirichlet and Fejer kernel; divergence of Fourier series of continuous functions; theorem of convergence in the L ^2 space 9. Holomorphic functions. Power series, analyticity. 10. Index of the curve. Cauchy's theorem for a simply connected domain; consequences. 11. Homologous curves. Global Cauchy's theorem
Prerequisites and co-requisites	Familiarity with the: - primitive set theory - calculus.
Assessment methods and criteria	see table below

Subject passing criteria	Passing threshold	Percentage of the final grade
Written exam	51.0%	40.0%
Activity in the classes	51.0%	10.0%
Midterm colloquium	51.0%	50.0%

Recommended reading		
	Basic literature	1. W. Rudin, Principles of mathematical analysis, McGraw-Hill, 1976 2. W. Rudin, Real and complex analysis, McGraw-Hill, 1987 3. F. Leja, Funkcje zespolone, Wydawnictwo naukowe PWN 2006
	Supplementary literature	1. J. Chądzyński, Wstęp do analizy zespolonej, Wydawnictwo Uniwersytetu Łódzkiego, 2008
	eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed	Check the pointwise/uniform convergence of a sequence of functions Calculate the sum of a series of functions Show examples of Baire theorem Expand a function in a Fourier series Calculate the index of the curve
Work placement	Not applicable