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 2024	Academic year of realisation of subject	2024/2025
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	Zakład Analizy Nieliniowej -> Instytut Matematyki Stosowanej -> Faculty of Applied Physics and Mathematics		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Marcin Styborski	
	Teachers	mgr inż. Urszula Goławska 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] uses differential and integral calculus, elements of complex analysis, algebraic methods, applies them in typical practical	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_U07] at an advanced level and covering modern mathematics, applies and presents in speech and in writing the content and methods of a selected branch of mathematics	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] has enhanced knowledge of basic branches of mathematics,demonstrates knowledge theorem and hypotheses, has understanding of the role and importance of mathematical reasoning structure.	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
[K7_U02] has the ability to check the correctness of conclusions in constructing formal proofs, sees formal structures related to the basic areas of mathematics and understands the importance of their properties.	The student is able to verify proofs based on rule of inference and consciously uses elementary methods and reasoning.	[SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools

<table>
<tr><td>Subject contents</td><td>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</td></tr>
<tr><td>Prerequisites
and co-requisites</td><td>Familiarity with the:

- primitive set theory

- calculus.</td></tr>
<tr><td>Assessment methods
and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Written exam</td><td>51.0%</td><td>40.0%</td></tr>
<tr><td>Activity in the classes</td><td>51.0%</td><td>10.0%</td></tr>
<tr><td>Midterm colloquium</td><td>51.0%</td><td>50.0%</td></tr>
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</td></tr>
<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>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</td></tr>
<tr><td>Supplementary literature</td><td>1. J. Chądzyński, Wstęp do analizy zespolonej, Wydawnictwo Uniwersytetu Łódzkiego, 2008</td></tr>
<tr><td>eResources addresses</td><td>Adresy na platformie eNauczanie:</td></tr>
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</td></tr>
<tr><td>Example issues/
example questions/
tasks being completed</td><td>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</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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