University of Gdańsk

Subject card

Subject name and code	Analytic functions I, PG_00155365		
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	Optional subject group Specialty subject group
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	Institute of Mathematics -> Faculty of Mathematics, Physics and Informatics -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	dr Iwona Krzyżanowska	
	Teachers	dr Iwona Krzyżanowska dr Aleksandra Nowel	

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	Introduction of basic concepts regarding the complex plane and the analysis of complex functions of one variable. Proving the most important theorems regarding analytical functions. Applications.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[MATMU2_U03] can understand mathematical texts of various types from selected fields of mathematics	Using the theory learned during the lecture, the student is able to examine the properties of analytical functions and series, integrals and points associated with these functions.	[SU5] implementation of a problem task [SU8] observation of student's independent or team work
[MATMU2_U05] can perform proofs in a selected field and, if necessary, also use tools from other areas of mathematics	The student is able to prove the most important theorems regarding the theory of analytic functions; knows examples showing the importance of the assumptions contained in these statements.	[SU4] test/exam - oral or written
[MATMU2_U06] is able to apply methods and examples from a selected field of mathematics in related fields	Using the theory learned during the lecture, the student is able to examine the properties of analytical functions and series, integrals and points associated with these functions.	[SU5] implementation of a problem task
[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 ready to precisely formulate questions to deepen his or her understanding of a given topic or find missing elements of reasoning.	[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 understands the importance of the assumptions of the formulated statements.	[SW4] test/exam - oral or written
[MATMU2_U04] is able, at an advanced level and including modern mathematics, to apply and present, orally and in writing, methods of at least one selected branch of mathematics	The student is able to independently solve problems and tasks based on the theory presented during the lecture.	[SU4] test/exam - oral or written [SU5] implementation of a problem task
[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, also in foreign languages.	[SK8] observation of student's independent or team work
[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 is ready to understand and appreciate the importance of intellectual honesty in his own and other people's actions; ethical conduct.	[SK4] test/exam - oral or written [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 prove the most important theorems regarding the theory of analytic functions; knows examples showing the importance of the assumptions contained in these statements.	[SU4] test/exam - oral or written
[MATMU2_W03] knows and understands in-depth a selected field of theoretical or applied mathematics and is able to understand the formulations of issues in this field that are still at the research stage and knows the connections of issues in this field with other areas of mathematics	The student knows and understands basic definitions, theorems and the scope of program content.	[SW4] test/exam - oral or written [SW5] implementation of a problem task
[MATMU2_K01] is willing to acknowledge the limitations of his or her own knowledge and is willing to pursue further education	The student is ready to acknowledge the limitations of his or her own knowledge and is ready to pursue further education.	[SK8] observation of student's independent or team work
[MATMU2_U07] is able to define his/her interests and develop them; in particular, is able to establish contact with specialists in his/her field, e.g. understand their lectures intended for young mathematicians	The student is able to independently solve problems and tasks based on the theory presented during the lecture.	[SU4] test/exam - oral or written [SU5] implementation of a problem task
[MATMU2_K06] is ready to formulate opinions on basic mathematical issues	The student is ready to formulate opinions on basic mathematical issues.	[SK5] implementation of a problem task
[MATMU2_W01] knows and understands in-depth the theory of selected areas of mathematics	The student knows and understands basic definitions, theorems and the scope of program content.	[SW4] test/exam - oral or written [SW5] implementation of a problem task

<table>
<tr><td>Subject contents</td><td>• Reminder of the basic algebraic and topological properties of the set of complex numbers.
• Power series and their convergence.
• Complex functions of a real variable, exponential functions, trigonometric functions, Euler's formula.
• Complex logarithm and power of a complex number.
• Differentiable functions, derivatives and their basic properties.
• Holomorphic function. Cauchy-Riemann equations, sufficient and necessary conditions for differentiability.
• Linear integral of a complex function, basic properties.
• Cauchy's theorem and theorem about the existence of a primary function.
• Cauchy's integral formula.
• Holomorphic function as a power series, Morera's theorem.
• Zeros of the holomorphic function.
• The principle of maximum.
• Liouville's theorem. Laurent series, expansion of the holomorphic function into the Laurent series.
• Isolated singular points.
• Residuum of functions, residual theorem and its application to computing improper integrals of real functions.
• Function sequences of holomorphic functions.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>none</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>Observation of the student's attitude</td><td>100.0%</td><td>0.0%</td></tr>
<tr><td>Exam</td><td>50.0%</td><td>55.0%</td></tr>
<tr><td>Testes</td><td>50.0%</td><td>45.0%</td></tr>
</table></td></tr>
<tr><td>Recommended reading</td><td><table>
<tr><td>Basic literature</td><td>1. F. Leja, Teoria funkcji analitycznych, PWN
2. J. Długosz, Funkcje zespolone. Teoria, przykłady, zadania</td></tr>
<tr><td>Supplementary literature</td><td>• W. Rudin, Analiza rzeczywista i zespolona
• J. Krzyż, Zbiór zadań z funkcji analitycznych
• J. Chądzyński, Wstęp do analizy zespolonej w zadaniach</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td>none</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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