University of Gdańsk

Subject card

| | | | |
|---|---|---|---|
| Subject name and code | Analytic Functions I, PG_00206879 | | |
| Field of study | Mathematics | | |
| Date of commencement of studies | October 2026 | Academic year of realisation of subject | 2026/2027 |
| Education level | Master's studies | Subject group | Obligatory subject group in the field of study<br>Optional subject group<br>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 | 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 Szymon Myga | |
| | 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: 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 | 3.0 | 62.0 | 125 |

**Subject objectives**

Introduction to basic techniques of complex analysis: computational methods and proofs. Introduction to basic concepts of the complex plane and complex analysis of functions of one complex variable. Proving the most important theorems concerning analytic functions. Presentation of applications. Presentation and interpretation of similarities and differences between functions defined in the real and complex domains, with particular emphasis on differentiability.

## Learning outcomes

| Course outcome | Subject outcome | Method of verification |
|---|---|---|
| [MATMU2_W02] knows and understands in depth the role and importance of the construction of mathematical reasoning | The student understands the sequence of ideas in the curriculum and sees the dependence of new constructions on previously proven facts. | [SW4] test/exam - oral or written |
| [MATMU2_U01] is able to construct mathematical reasoning: prove theorems, formulate, test and refute hypotheses by constructing and selecting counterexamples, choosing, if necessary, methods and tools from various areas of mathematics | The student knows proofs, examples, and counterexamples. He or she can prove simple facts. | [SU4] test/exam - oral or written<br>[SU5] implementation of a problem task |
| [MATMU2_W03] knows and understands to a deep degree 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 between issues in this field and other areas of mathematics | The student knows the subject and is able to express ideas using its terminology. He/she understands basic open problems. | [SW4] test/exam - oral or written |
| [MATMU2_W01] knows and understands in depth the theory of selected areas of mathematics or related fields, the complex relationships between them and their development trends | The student knows and understands in-depth definitions and theorems related to the curriculum content. | [SW4] test/exam - oral or written |

## Subject contents

- A review of basic algebraic and topological properties of complex numbers.
- Power series and their convergence.
- Complex functions of a real variable, exponential functions, trigonometric functions, Euler's formula. The complex logarithm and the power of a complex number.
- Differentiable functions, derivatives, and their basic properties. Formal derivatives.
- The holomorphic function. The Cauchy-Riemann equations, sufficient and necessary conditions for differentiability.
- The line integral of a complex function, basic properties.
- Cauchy's theorem and the theorem on the existence of an antiderivative. Cauchy's integral formula.
- Expandability of a holomorphic function into a power series, Morera's theorem.
- Zeros of a holomorphic function. Rouche's theorem.
- The maximum principle. Schwarz's lemma and other applications.
- Entire functions. Liouville's theorem.
- Laurent series, expansion of a holomorphic function into a Laurent series.
- Isolated singular points. Residue of a function, the residue theorem and its application to computing improper integrals of real functions.
- Meromorphic functions.
- Sequences of holomorphic functions.

## Prerequisites and co-requisites

Mathematical analysis of one and several real variables.

## Assessment methods and criteria

| Subject passing criteria | Passing threshold | Percentage of the final grade |
|---|---|---|
| exam | 51.0% | 60.0% |
| Observation of the student's attitude | 51.0% | 0.0% |
| tests | 51.0% | 40.0% |

## Recommended reading

Basic literature

1. F. Leja, Teoria funkcji analitycznych, PWN

2. J. Długosz, Funkcje zespolone. Teoria, przykłady, zadania

| | | |
|---|---|---|
| | Supplementary literature | 1. W. Rudin, Analiza rzeczywista i zespolona<br>2. J. Krzyż, Zbiór zadań z funkcji analitycznych<br>3. J. Chądzyński, Wstęp do analizy zespolonej w zadaniach |
| | eResources addresses | |
| Example issues/ example questions/ tasks being completed | none | |
| Work placement | Not applicable | |

Document generated electronically. Does not require a seal or signature.