Course Specifications

Valid as from the academic year 2024-2025

Complex Analysis (C003568)

Course size *(nominal values; actual values may depend on programme)*

Credits 6.0 **Study time 165 h**

Course offerings and teaching methods in academic year 2025-2026

A (semester 1)	Dutch	Gent	seminar
			lecture

Lecturers in academic year 2025-2026

Vernaeve, Hans	WE16	lecturer-in-charge

Offered in the following programmes in 2025-2026	crdts	offering
Bachelor of Science in Mathematics	6	A
Preparatory Course Master of Science in Mathematics	6	A

Teaching languages

Dutch

Keywords

analysis of functions of one complex variable, holomorphic and meromorphic functions

Position of the course

This course offers a well-founded introduction to the analysis of functions of one complex variable. Both practical aspects (e.g. evaluation of integrals by means of the residue theorem) and theoretical aspects are treated. Connections with other mathematical subjects (analytic number theory, noneuclidean geometry) are indicated. The theory is elucidated by exercises aiming at self-activation, creativity and sharpening insight in the theory.

Contents

Functions of one complex variable: several characterizations of holomorphy: complex differentiability, Cauchy-Riemann equations, conformality, power series, line integrals, funcdamental theorem of Cauchy, Cauchy integral theorem, Morera theorem, Goursat theorem. Liouville theorem and fundamental theorem of Algebra.
Elementary complex functions (exponential, logarithm, power functions, goniometric functions).
Poles, removable and essential singularities, development in Laurent series.
Residue theorem with applications (evaluation of integrals).
Argument principle, Möbius transformations, Schwarz inequality, Poincaré circle model of hyperbolic geometry. Maximum principle, connection with harmonic functions.
First introduction to analytic number theory (Riemann zeta function, prime number theorem (without proof)).
Optional topics: Mittag-Leffler theorem, Riemann mapping theorem (without proof), Riemann surfaces, Picard theorem (without proof), functional equation for the Riemann zeta function.

Initial competences

Final competences of the courses Analysis I and Analysis II.

Final competences

1 To explain when a concrete function in the complex plane is holomorphic if it is an extension to (part of) the complex plane of a combination of elementary functions from the analysis of functions in one real variable.

2 To explain when a concrete function in the complex plane is holomorphic if it satisfies certain properties.
3 To deduce useful information by means of properties of holomorphic functions about concrete holomorphic functions, which is otherwise hard to obtain, and to obtain by it the insight that an extension of the domain from the real axis to the complex plane often yields a simpler and more elegant analysis of mathematical functions.
4 To calculate real integrals by means of complex contour integration and the use of the residu theorem.
5 To give complete reasonings in complex analysis by combining the proofs given in class with an own creative combination of the methods taught in class.

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Seminar, Lecture

Extra information on the teaching methods

Parts of the theory are taught in an activating way.

Study material

Type: Syllabus

Name: Complex analysis (Dutch)
Indicative price: Free or paid by faculty
Optional: no
Language : Dutch
Number of Pages : 150
Oldest Usable Edition : 2023-2024
Available on Ufora : Yes
Online Available : Yes
Available in the Library : No
Available through Student Association : No
Additional information: PDF file, free to be used and printed

References

Course content-related study coaching

Besides regular support by the officially appointed coaches, the lecturer is available for answering individual questions, also outside of the lecture periods (on appointment).Students can also have their independently solved exercises corrected.

Assessment moments

end-of-term assessment

Examination methods in case of periodic assessment during the first examination period

Written assessment with open-ended questions

Examination methods in case of periodic assessment during the second examination period

Written assessment with open-ended questions

Examination methods in case of permanent assessment

Possibilities of retake in case of permanent assessment

not applicable

Extra information on the examination methods

The theory part of the exam is a written examination in which it is tested whether the student has acquired a sufficient amount of knowledge and insight in the course material. The exercise part of the exam is a written open book examination.

Calculation of the examination mark

100% periodic evaluation