Faculty of Science

MATM32, Mathematics: Complex Analysis 2, 7.5 credits

Matematik: Komplex analys 2, 7,5 högskolepoäng

Second Cycle / Avancerad nivå

Details of approval

The syllabus was approved by The Education Board of Faculty of Science on 2024-12-02. The syllabus comes into effect 2024-12-02 and is valid from the autumn semester 2025.

General information

The course is an alternative-compulsory course at advanced level for a Master of Science Degree in mathematics.

Language of instruction: English

Main field of study	*Specialisation*
Mathematics	A1N, Second cycle, has only first-cycle course/s as entry requirements

Learning outcomes

The overall goal of the course is that the student devdelop an in-depth understanding of fundamental concepts, results, and methods in the theory of analytic functions, and the ability to apply these to describe, analyze, and solve relevant problems related to complex analysis. The course aims to develop student' ability to communicate mathematics orally and in writing and to read mathematical texts. It also aims to prepare the student for further studies in mathematics, science, and technology.

Knowledge and understanding

After completing the course, students should be able to:

- thoroughly explain the relationships between the main concepts and results included in the course and illustrate these with examples
- explain how the main concepts and results of the course are related to solution methods for relevant problems in complex analysis.

Competence and skills

After completing the course, students should be able to:

- confidently apply basic methods to solve relevant calculation tasks within the course content
- demonstrate good calculation skills
- present solutions to relevant calculation tasks orally and in writing, logically coherent, and with appropriate terminology
- derive basic relationships between key concepts and reproduce proofs for the main results included in the course.

Judgement and approach

After completing the course, students should be able to:

- evaluate available solution methods in problem-solving and choose an appropriate solution method
- argue for the value of mathematical theory in problem-solving
- argue for the value of mathematical analysis in other sciences.

Course content

The course treats:

- Convergence of sequences of analytic functions. Locally uniform convergence, normal families, Montel's theorem.
- In-depth study of conformal mappings. Riemann sphere, stereographic projection, Möbius transformations, disk automorphisms, Schwarz lemma, Riemann mapping theorem.
- Entire functions. Infinite products, factorization, order, genus. Fourier transforms and Paley-Wiener spaces.
- Harmonic and subharmonic functions. Maximum principle, Harnack's principle, and application to Dirichlet's problem in suitable domains.

Course design

The teaching consists of lectures and seminars. The seminars are based on selected exercises and require active student participation, including preparation.

Assessment

The examination consists of a written examination and an oral examination at the end of the course. The oral examination is only given for students who have passed the written examination.

Students who do not pass the regular written and oral examinations are offered additional examination opportunities shortly thereafter.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Grades

Grading scale includes the grades: Fail, Pass, Pass with distinction
The grading scale for the written and the oral examination is Fail, Pass.

To achieve the final grade of Pass for the entire course, the student must have obtained a Pass grade on all the included examination components.

In addition, the grade Pass with distinction requires that the total number of marks obtained in the written and the oral examination is not less than 75% of the accumulated maximal number of points. The maximal number of marks that can be obtained in the written and the oral examination are weighted three to two.

Entry requirements

For admission to the course, at least 90 credits are required, including basic knowledge in complex analysis corresponding to, for example, MATC21 Analytic Functions 1, 7.5 credits.

Further information

The course may not be included in degree together with the course MATM12 Analytic Functions, 15 credits.

The course is given at the Centre for Mathematical Sciences, Lund University.