LUNDS UNIVERSITET
Lunds Tekniska Högskola

Course syllabus

Matematik - Funktionsteori
Mathematics - Analytic Functions

FMAF01, 7 credits, G2 (First Cycle)

Valid for: 2018/19
Decided by: PLED F/Pi
Date of Decision: 2018-03-23

General Information

Main field: Technology.
Compulsory for: E2, F2, I2, Pi2
Elective Compulsory for: D2
Elective for: BME4, C4, M4, N3
Language of instruction: The course will be given in English on demand

Aim

The aim is to provide concepts and methods from real and complex analysis which are important for further studies within for example mathematics, economy, physics, field theory, mathematical statistics, control theory, signal theory, and for professional work in the future. The aim is also to make the students develop their ability to solve problems, to assimilate mathematical text and to communicate mathematics.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- be able to account for the definitions and properties of the elementary analytic functions.
- be able to explain the basic theory of analytic functions (derivatives and integrals).
- be able to show an understanding of the concept of convergence of a series, och be familiar with and be able to use some criteria to decide convergence.
- be able to show an understanding of how functions and signals can be represented in different ways, as sequences and as function series.
- have some experience of and understanding of mathematical and numerical software.

Competences and skills
For a passing grade the student must

- be able to demonstrate an ability to independently choose appropriate methods to solve linear difference equations, and to carry out the solution essentially correctly.
- be able to demonstrate an ability to independently choose appropriate methods to decide whether a numerical series converges or diverges, and, in the case of convergence, to estimate its sum with different methods.
- be able to demonstrate a good ability to identify situations where different kinds of Fourier expansions are suitable, and to choose appropriate methods to derive such expansions.
- be able to demonstrate an ability to independently choose appropriate methods to decide whether a function series can be differentiated or integrated term-wise.
- be able to demonstrate an ability to independently choose appropriate methods to solve problems connected to analytic functions.
- be able to demonstrate an ability to choose appropriate methods to evaluate some types of real integrals by means of residue calculus.
- in connection with problem solving be able to demonstrate an ability to integrate knowledge from the different parts of the course.
- with proper terminology, in a well-structured manner and with clear logic be able to explain the solution to a problem.

Contents

Sums and series: sequences, difference equations, numerical series, absolute and conditional convergence. Function sequences and function series. Norms of functions and uniform convergence.

Power series: radius of convergence, integration and differentiation of power series, power series expansions of the elementary functions.

Fourier series: exponential and trigonometric Fourier series, questions of convergence, Parseval's formula.

Analytic functions: definition of an analytic function, the Cauchy-Riemann equations. Elementary analytic functions. Cauchy's integral theorem and integral formula. Expansion in power series. The identity theorem. The residue theorem. Calculation of real integrals by residue calculus.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)
Assessment: Written test comprising theory and problems. Assignments, requiring work with and without computer, which have to be completed BEFORE the exam.

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.

Parts
Code: 0116. **Name:** Analytic Functions.
Credits: 7. **Grading scale:** TH.
Code: 0216. **Name:** Assignments.

Credits: 0. **Grading scale:** UG.

Admission

Admission requirements:

- At least 13 university credits, in total, of the courses FMAA05 and FMAB30

Required prior knowledge: Linear algebra (FMAB20) and calculus in one and several variables (FMAA01/FMAA05 and FMAB30).
The number of participants is limited to: No
The course overlaps following course/s: FMA030, FMA037, FMA280

Reading list

- Wikström, F: Funktionsteori. Studentlitteratur, 2014, ISBN: 978-91-44-09375-8.
- Wikström, F: Funktionsteori, övningsbok. Studentlitteratur, 2016, ISBN: 9789144115061.

Contact and other information

Course coordinator: Studierektor Anders Holst, Studierektor@math.lth.se
Course administrator: Studerandeexpeditionen, expedition@math.lth.se
Course homepage: http://www.maths.lth.se/course/funkteori/
Further information: In order for an exam to be graded it is necessary that the examinee has passed on the assignments before the exam.