Faculty of Science

MATM38, Mathematics: Fourier Analysis, 7.5 credits

Matematik: Fourieranalys, 7,5 högskolepoäng

Second Cycle / Avancerad nivå

Details of approval

The syllabus was approved by Study programmes board, Faculty of Science on 2020-06-08 and was last revised on 2025-05-14 by The Education Board of Faculty of Science. The revised syllabus comes into effect 2025-05-14 and is valid from the spring semester 2026.

General information

The course is an alternative-compulsory course for second-cycle studies leading to a Degree of Master of Science in Mathematics. It can also be included as an elective course for the Degree of Bachelor of Science in Mathematics and may be taken as a stand-alone course.

Language of instruction: English
The course can be given in English when necessary.

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 should acquire a solid understanding of the techniques of modern Fourier analysis and develop the ability to apply them in various areas of mathematics and its applications.

Knowledge and understanding

After completing the course, the student should be able to:

- give a detailed account of the concepts and methods within Fourier analysis included in the course
- identify the most important theorems in the course and present their proofs

- explain the theory behind the methods used in Fourier analysis within the framework of the course
- give examples of important applications of Fourier analysis in different settings both within and outside mathematics.

Competence and skills

After completing the course, the student should be able to:

- critically and systematically integrate knowledge from different areas of mathematics to analyse and solve complex problems by means of Fourier analysis
- independently and creatively identify, formulate and solve relevant problems within the framework of the course
- in oral and written form, present solutions to mathematical problems within the framework of the course, logically coherent and with adequate terminology.

Judgement and approach

After completing the course, the student should be able to:

- argue for the role of Fourier analysis in mathematics and theoretical physics.

Course content

The course treats:

- Fourier series, the Fourier transform in one and several variables, and the Fourier transform on finite commutative groups
- L^2 convergence of Fourier series, pointwise convergence
- Cesàro means and Fejer's theorem, Weyl's criterion
- The Fourier inversion theorem, Parseval's and Plancherel's theorem, Poisson summation formula, and the Heisenberg inequality
- Examples of applications in physics and in other areas of mathematics, including dynamical systems, number theory, and partial differential equations.

Course design

The teaching consists of lectures and seminars. Assignments are included in the course.

Assessment

The examination consists of a written examination and a corresponding oral examination at the end of the course. The oral examination is only given to those students who have passed the written examination. Completed assignments can give a certain amount of bonus points that can be counted towards the written examination; this will be specified at the start of the course.

Students who fail the regular written respectively oral examination are offered a re-examination 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
To pass the course it is required to pass the written examination and the oral examination. To obtain the grade Pass with distinction it is required in addition that the total number of points obtained in the written and the oral examination is at least 75% of the maximum total number of points. The maximum numbers of points that can be obtained in the written and the oral examinations are weighted three to one.

Entry requirements

To be admitted to the course, the student must have completed at least 90 credits, of which 75 credits must be in mathematics, including knowledge equivalent to the course MATB34 Linear Analysis (7.5 credits).

The courses MATC21 Complex Analysis 1 (7.5 credits) and MATM39 Integration Theory (7.5 credits) are recommended but not compulsory.

Further information

The course may not be included in a degree together with MATM18 Fourier Analysis, 7.5 credits.

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