Faculty of Science

MATM48, 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 2022-06-03 to be valid from 2022-06-03, spring semester 2023.

General Information

The course is an elective course for second-cycle studies for a Degree of Master of Science (120 credits) in mathematics. The course is also given as a free-standing course.

Language of instruction: English

Main field of studies	*Depth of study relative to the degree requirements*
Mathematics	A1F, Second cycle, has second-cycle course/s as entry requirements

Learning outcomes

On completion of the course, students are to have acquired knowledge about modern Fourier analysis. The course assumes that students are familiar with the Lebesgue integral, and have passed introductory courses in group theory, Fourier series and analytic functions. After having completed the course, the students should be able to use the techniques from the course in different 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,
- present solutions to mathematical problems within the framework of the course in speech and in writing, logically coherent and with adequate terminology.

Judgement and approach

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

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

Course content

The course treats:

- L^1 and L^2 theory of Fourier series and integrals,
- pointwise convergence and summation methods (with respect to "good" kernels) of Fourier series and integrals,
- the finite Fourier transform, including the Fast Fourier transform algorithm,
- examples of applications in physics and in other areas of mathematics, such as dynamical systems, number theory, uncertainty principles, harmonic analysis and partial differential equations.

Course design

The teaching consists of lectures and seminars. Homework 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. Well executed homework assignments give bonus points that count towards the written examination.

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.

Subcourses that are part of this course can be found in an appendix at the end of this document.

Grades

Marking scale: Fail, Pass, Pass with distinction.
To pass the course it is required to pass the written examination and the oral examination. The grade Pass with distinction requires 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

For admission to the course, English 6/B is required as well as at least 90 credits, of which 75 credits in mathematics, including introductory courses covering:

- Fourier series for continuous functions (e.g., MATB24)
- group theory (e.g., MATM31)
- analytic functions (e.g., the first half of MATM12)
- Lebesgue integration (e.g., MATM39)

Further information

The course may not be included in a degree together with MATM18 Fourier Analysis or MATM38 Fourier Analysis, both 7.5 credits.

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

Subcourses in MATM48, Mathematics: Fourier Analysis

Applies from V23

2301 Written Examination, 5,0 hp
Grading scale: Fail, Pass
2302 Oral Examination, 2,5 hp
Grading scale: Fail, Pass