Faculty of Science

MATP39, Mathematics: Specialised Course in Integration Theory, 7.5 credits

Matematik: Fördjupningskurs till integrationsteori, 7,5 högskolepoäng

Second Cycle / Avancerad nivå

Details of approval

The syllabus was approved by Study programmes board, Faculty of Science on 2020-05-28 and was last revised on 2024-06-10 by The Education Board of Faculty of Science. The revised syllabus comes into effect 2024-06-10 and is valid from the spring semester 2025.

General information

The course is an alternative-compulsory course for second-cycle studies for a degree of Master of Science (120 credits) in mathematics. The course is also given as a stand-alone course.

Language of instruction: English

Main field of study	*Specialisation*
Mathematics	A1F, Second cycle, has second-cycle course/s as entry requirements

Learning outcomes

The overarching goal of the course is for the students to acquire a deeper understanding of advanced results and methods in the field of integration theory. Students will be provided with a powerful and general machinery leading to a deeper understanding of aspects of modern analysis.

Knowledge and understanding

After completing the course the student should be able to:

- give a detailed account of the concepts, theorems and methods, such as existence proofs derived from extremal problems, use of Vitalli coverings, and other ideas that are treated in the course,

- identify the main theorems of the course, describe the main ideas and carry out the steps in their proofs,
- give an account of research aspects within the subject and relate it to relevant problems within an independent project work.

Competence and skills

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

- integrate knowledge from the different parts of the course in connection with problem solving,
- identify problems that can be solved by methods that are part of the course and use appropriate solution methods,
- explain the solution to related mathematical problems, in speech and in writing, logically coherent and with adequate terminology,
- plan and execute qualified tasks within a given time frame.

Judgement and approach

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

- identify situations where the advanced methods of integration theory apply, for example in other areas such as probability theory and functional analysis.

Course content

The course treats basic properties of signed and complex measures:

- Hahn and Jordan decomposition
- absolute continuity and the Radon-Nikodym theorem, singularity, Lebesgue decomposition of measures
- differentiability of finite Borel measures on R^d, differentiability of absolutely continuous functions
- Riesz representation theorem
- the Hardy-Littlewood maximal function and the weak type estimate for it
- Haar measures

Course design

The teaching consists of lectures and seminars.

Assessment

The assessment consists of a written take-home examination (3 cr) during the course as well as of a written report (3 cr) and oral presentation (1.5 cr) of a specialised project at the end of the course.

For students who have not passed the regular examination, an additional examination opportunity is offered during the scheduled re-examination period.

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 take-home examination as well as for the written report and the oral presentation of the specialised project is Fail, Pass, Pass with distinction.

In order to obtain the grade Pass on the entire course, the grade pass is required on all examination parts. In order to obtain the grade Pass with distinction, it is required in addition to obtain the grade Pass with distinction on at least two of the examination parts.

Entry requirements

For admission to the course, English 6/B and at least 90 credits in mathematics are required, in which should be included the course MATM39 Integration theory, 7.5 credits, or equivalent.

Further information

The course may not be included in a higher education qualification together with MATP24 Advanced course in integration theory 7.5 credits or MATP29 Specialised Course in Integration Theory 7.5 credits.

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