



LUND
UNIVERSITY

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 to be valid from 2020-05-28, spring semester 2021.

General Information

The course is an elective course for second-cycle studies for a degree of Master of Science (120 credits) in mathematics.

Language of instruction: English

Main field of studies

Mathematics

Depth of study relative to the degree requirements

A1F, Second cycle, has second-cycle course/s as entry requirements

Learning outcomes

The main goal of the course is to give a presentation of some central results in integration theory, as well as the modern measure-theoretic approach to differentiation of functions. The students will be provided with a powerful and general machinery leading to a deeper understanding of aspects of modern analysis, like for example, harmonic 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 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, partial differential equations and function spaces, especially Sobolev spaces.

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 \mathbb{R}^d , differentiability of absolutely continuous functions,
- the Hardy-Littlewood maximal function and the weak type estimate for it,
- the Hardy-Littlewood maximal function of L^p -functions, $p > 1$.

Course design

The teaching consists of lectures and seminars.

Assessment

The examination consists of oral presentations of solutions of problems or proofs of relevant results during the course and a problem-solving project at the end of the course.

Students who fail the regular 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 problem-solving project and at least one oral presentation. Points are given for each oral presentation. To obtain the grade Pass with distinction it is required that the total number of points obtained in the problem-solving project and oral presentations is not less than 75% of the maximal number of points. The maximal number of points that can be obtained in the problem-solving project and the oral presentations are weighted six to one.

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.

Subcourses in MATP39, Mathematics: Specialised Course in Integration Theory

Applies from V21

- 2101 Oral Presentation, 0,5 hp
Grading scale: Fail, Pass
- 2102 Project, 7,0 hp
Grading scale: Fail, Pass