



LUND
UNIVERSITY

Faculty of Science

MATM44, Mathematics: Introduction to Algebraic Topology, 7.5 credits

Matematik: Introduktion till algebraisk topologi, 7,5 högskolepoäng
Second Cycle / Avancerad nivå

Details of approval

The syllabus was approved by Study programmes board, Faculty of Science on 2022-12-12 to be valid from 2022-12-12, spring semester 2024.

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 this course is to give the students an introduction to the modern theory of algebraic topology, important for further studies in the subject and in relevant areas of physics and other areas. The purpose is further that the students develop their ability to solve problems and communicate mathematical reasoning.

Knowledge and understanding

After completing the course the student should be able to:

- give an account of the concepts and methods within modern algebraic topology that are treated in the course,
- identify the most important results in the course and give an account of their proofs,
- give a detailed account of the theory behind the methods used in modern algebraic topology within the framework of the course.

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,
- describe the solution of a mathematical problem within the course framework, in speech and writing, logically coherent and with adequate terminology,
- plan and carry out relevant assignments for the course using appropriate methods within a given time frame.

Judgement and approach

After completing the course the student should be able to:

- argue for the importance of modern algebraic topology as a tool in other areas, e.g. modern physics.

Course content

The course covers:

- homotopy theory, the fundamental group, covering spaces,
- the Brouwer fixed point theorem, the Borsuk-Ulam theorem,
- deformation retracts, fundamental groups and homology of surfaces,
- surgery of manifolds, also called "cutting and pasting",
- the construction and classification of compact surfaces.

Course design

The teaching consists of lectures and seminars. A compulsory assignment is included in the course. The assignment should be solved in smaller groups and the solutions should be presented orally to the entire student group.

Assessment

The examination consists of an oral examination at the end of the course, as well as an oral presentation of a group assignment during the course.

Students who fail the regular 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 oral examination and the oral presentation of group assignment. The grading scale for the group assignment is Fail, Pass. The grading scale for the oral examination is Fail, Pass, Pass with Distinction. The

final grade is determined by the grade on the oral examination.

Entry requirements

For admission to the course, English 6/B as well as at least 90 credits, with at least 60 credits in mathematics are required, including knowledge corresponding to the courses MATB22 Linear Algebra 2, 7.5 credits, MATB23 Analysis in Several Variables 2, 7.5 credits, and MATM33 Differential Geometry, 7.5 credits.

Further information

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

Subcourses in MATM44, Mathematics: Introduction to Algebraic Topology

Applies from V24

- 2401 Oral Examination, 6,5 hp
Grading scale: Fail, Pass, Pass with distinction
- 2402 Oral presentation of group assignment, 1,0 hp
Grading scale: Fail, Pass