



**LUND**  
UNIVERSITY

Faculty of Science

## **MATM43, Mathematics: Specialised Course in Differential Geometry, 7.5 credits**

*Matematik: Fördjupningskurs till differentialgeometri, 7,5  
högskolepoäng*

**Second Cycle / Avancerad nivå**

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### **Details of approval**

The syllabus was approved by Study programmes board, Faculty of Science on 2020-06-02 to be valid from 2020-06-02, 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 overall goal of the course is to provide an introduction to modern differential geometry, important for further studies in the subject and in relevant areas of physics. In particular connections with Einstein's general relativity. The purpose is further to develop the students' 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 differential geometry 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 differential geometry 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 to 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 differential geometry as a tool in other areas, e.g. modern physics.

### **Course content**

The course covers:

- Differentiable manifolds, their tangent spaces and tangent bundles.
- Riemannian metrics and their unique Levi-Civita connection.
- Geodesics and the important Riemann curvature tensor and its influence on the local geometry.

### **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 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. In addition, the grade Pass with distinction requires that the number of points obtained at the oral examination is at least 75%.

## 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 may not be included in a degree together with MATM23 Specialised Course in Differential Geometry, 7.5 credits.

## Subcourses in MATM43, Mathematics: Specialised Course in Differential Geometry

Applies from V21

- 2101 Oral Examination, 6,0 hp  
Grading scale: Fail, Pass
- 2102 Assignment, 1,5 hp  
Grading scale: Fail, Pass