Faculty of Science

MATC22, Mathematics: Ordinary Differential Equations 1, 7.5 credits

Matematik: Ordinära differentialekvationer 1, 7,5 högskolepoäng

First Cycle / Grundnivå

Details of approval

The syllabus was approved by The Education Board of Faculty of Science on 2024-12-03. The syllabus comes into effect 2024-12-03 and is valid from the autumn semester 2025.

General information

The course is an alternative-compulsory course for first-cycle studies for a Bachelor of Science degree in mathematics.

Language of instruction: English

Main field of study	*Specialisation*
Mathematics	G1F, First cycle, has less than 60 credits in first-cycle course/s as entry requirements

Learning outcomes

The overarching goal of the course is for the student to aquire knowledge about the fundamental concepts and methods in the theory of ordinary differential equations, and to be able to apply these to solve and analyze relevant problems in the subject. The course aims to allow the student to develop their ability to communicate mathematics orally and in writing, and to read mathematical texts. Additionally, the course aims to prepare the student for further studies in mathematics, natural sciences, and engineering.

Knowledge and understanding

On completion of the course, the student shall be able to:

- give an account of the connections between the key concepts and results included in the course and illustrate them with examples,

- reason about the benefits and limitations of explicit solution formulas and qualitative analysis methods.

Competence and skills

After completing the course, students should be able to:

- confidently apply basic methods to solve relevant numerical problems within the course content
- demonstrate good computational skills
- present solutions to relevant numerical problems both orally and in writing, logically coherent and with appropriate terminology
- derive basic connections between key concepts and reproduce proofs for the main results included in the course.

Judgement and approach

After completing the course, students should be able to:

- evaluate available solution methods in relation to problem-solving and choose appropriate solution methods
- critically analyze their own and other students' solutions, and assess solution alternatives in relation to each other
- argue for the value of mathematical theory in problem-solving
- argue for the value of differential equations as tools for modeling in other sciences.

Course content

The course treats:

- Existence and uniqueness of solutions to initial value problems for systems of ordinary differential equations.
- Approximation of solutions and continuous dependence on parameters.
- Linear systems with variable and constant coefficients. Fundamental matrices and the matrix exponential function.
- Autonomous systems. Phase portraits. Stability theory. Periodic solutions.
- Applications in other sciences.

Course design

Teaching consists of lectures and seminars. The seminars are based on selected exercises and require active student participation, including preparation. A compulsory assignment is included during the course.

Assessment

The examination consists of a written examination and an oral examination at the end of the course, as well as a compulsory assignment during the course. The oral examination is only given for students who have passed the written exam. Students who do not pass the regular written and oral examinations are offered additional examination opportunities 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.

Grades

Grading scale includes the grades: Fail, Pass, Pass with distinction
The grading scale for the written assignment as well as for the written and the oral examination is Fail, Pass.

To achieve the final grade of Pass for the entire course, the student must have obtained a Pass grade on all the included examination components.

In addition, the grade Pass with distinction requires that the total number of marks obtained in the written and the oral examination is not less than 75% of the accumulated maximal number of points. The maximal number of marks that can be obtained in the written and the oral examination are weighted three to one.

Entry requirements

The course requires basic knowledge in analysis in one and several variables and linear algebra, corresponding to, for example:

- MATA31Analysis in One Variable, 15 credits
- MATA32 Algebra and Vector Geometry, 7,5 credits
- MATB21 Analysis in Several Variables, 7,5 credits
- MATB23 Analysis in Several Variables 2, 7,5 credits
- MATB32 Linear Algebra, 7,5 credits

Additionally, knowledge equivalent to MATB33 Mathematics: Introduction to Higher Analysis, 7.5 credits, or FYSB21 : Mathematical Methods for Vibrations, Waves and Diffusion, 7.5 credits, is required.

Further information

The course cannot be credited in a degree together with the course MATC12 Ordinary Differential Equations 1 7.5 credits.

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