Faculty of Science

MATM20, Mathematics: Mathematical Modeling, 7.5 credits

Matematik: Matematisk modellering, 7,5 högskolepoäng

Second Cycle / Avancerad nivå

Details of approval

The syllabus was approved by Study programmes board, Faculty of Science on 2014-01-15 and was last revised on 2025-05-14 by The Education Board of Faculty of Science. The revised syllabus comes into effect 2025-05-14 and is valid from the spring semester 2026.

General information

The course is an alternative-compulsory course for second-cycle studies leading to a Degree of Master of Science in Mathematics. The course can be included as an elective course for the Degree of Bachelor of Science in Mathematics and may be taken as a stand-alone course.

Language of instruction: English

Main field of study	*Specialisation*
Mathematics	A1N, Second cycle, has only first-cycle course/s as entry requirements

Learning outcomes

The overall goal of the course is that the student should acquire a solid understanding of the mathematical modelling process, including its various stages and key tools such as optimisation techniques and differential equations. The course also aims to develop the student's practical skills in programming, oral and written communication, and critical evaluation of mathematical models.

Knowledge and understanding

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

- give a clear account of what a mathematical model is and explain the different stages of the modelling process

- explain some general tools for mathematical modelling, particularly in the fields of optimisation and differential equations.

Competence and skills

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

- apply the modelling process on problems in natural sciences and economics, independently and in groups
- independently write programs in the programming language Python or in a comparable programming language
- document and present his/her results both in speech and writing, even for non-specialists
- identify complex problems from the real world that can be solved with mathematical methods.

Judgement and approach

On completion of the course, the student should:

- be aware of the limitations of a mathematical model and of the uncertainty that arises owing to inadequate or lacked data and sjould be able to make appropriate considerations in this respect
- have contemplated the consequences of the use of mathematics in society.

Course content

The course addresses examples of mathematical models and the different stages of the modelling process: problem formulation, analysis, calculations, simulation and feedback. The mathematical models concern for example optimisation problems with constraints, linear optimisation problems, dynamical systems with discrete time and dynamical systems of differential equations, analysis of dynamical systems by means of phase portraits and eigenvalues, simulation of dynamical systems, fractals and chaotic solutions.

Course design

The teaching consists of lectures, seminars and projects. Participation in the projects as well as other teaching in connection with those is compulsory.

Assessment

The course is assessed trough a written examination at the end of the course as well as through oral and written presentation of projects. Students who fail the ordinary written examination are offered a resit 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.

Grades

Grading scale includes the grades: Fail, Pass, Pass with distinction
To pass the whole course it is required to pass the written examination and the project reports as well as to participate in all compulsory activities. The final grade is determined by the results on the written examination.

Entry requirements

To be admitted to the course, the student must have completed at least 90 credits, of which at least 60 credits must be in mathematics, including knowledge equivalent to the courses NUMA01 Computational Programming with Python (7.5 credits) and MATC22 Ordinary Differential Equations 1 (7.5 credits).

Further information

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