LUND UNIVERSITY

Faculty of Science

NUMN18, Numerical analysis for elliptic and parabolic differential equations, 7.5 credits

Numerisk analys för elliptiska och paraboliska differentialekvationer , 7,5 högskolepoäng

Second Cycle / Avancerad nivå

Details of approval

The syllabus was approved by Study programmes board, Faculty of Science on 2012-10-02 to be valid from 2013-07-01, autumn semester 2013.

General Information

The course is an elective course for second-cycle studies for a Degree of Master of Science (120 credits) in mathematics with a specialisation in numerical analysis.

Language of instruction: Swedish and English
The course is given in English if any participant so desires.

Main field of studies	*Depth of study relative to the degree requirements*
Mathematics	A1F, Second cycle, has second-cycle course/s as entry requirements

Learning outcomes

The aim of the course is that students on completion of the course should have acquired the following knowledge and skills:

Knowledge and understanding
On completion of the course, the student should:

- have obtained an understanding of how concepts from functional analysis are used to develop and analyse numerical algorithms for partial differential equations.

- have obtained a advanced knowledge of the interplay between type of differential equation and choice of numerical algorithm.
- have developed a good understanding of concepts such as stability and convergence.

Skills and abilities
On completion of the course, the student should:

- be able to derive simple error estimates.
- be able to identify important classes of partial differential equations and be able to utilise this to discretize given equations efficiently.
- be able to give examples of important fields of applications in which the algorithms occurring in the course are important.

Judgement and approach
On completion of the course, the student should:

- in simple cases be able to balance choice of complexity in model against computability to obtain good precision.

Course content

Error estimates, convergence and stability. Existence and regularity of solutions to ordinary, elliptic and parabolic differential equations. Analysis of the Finite Difference Method and the Finite Element Method. Analysis of time step methods, e g implicit Runge-Kutta methods. The interplay between the discretizations in space and time. Applications of partial differential equations e g heat conduction and reaction-diffusion processes.

Course design

The teaching consists of lectures and problem solving classes.

Assessment

Examination consists of a written exam and an associated oral exam. The oral exam may only be taken by those students who pass on the written exam. Students who fail the regular exam are offered a re-examination shortly afterwards.

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.
The final grade is based on the joint results on the two exams.

Entry requirements

For admission to the course, knowledge equivalent to NUMN12 Numerical methods for differential equation, 7.5 credits, and MATP15 Linear functional analysis, 7.5 credits, is required.

Subcourses in NUMN18, Numerical analysis for elliptic and parabolic differential equations

Applies from H13

1201 Elliptic and Parabolic Differential Equations, 7,5 hp
Grading scale: Fail, Pass, Pass with distinction