SF1682 Analytical and Numerical Methods for Differential Equations 11.0 credits

Analytiska och numeriska metoder för differentialekvationer

This is a translation of the Swedish, legally binding, course syllabus.

If the course is discontinued, students may request to be examined during the following two academic years

Establishment

Course syllabus for SF1682 valid from Autumn 2019

Grading scale

A, B, C, D, E, FX, F

Education cycle

First cycle

Main field of study

Technology

Specific prerequisites

Completed basic course SF1626 Calculus in Several Variable.

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

After the course the student should be able to

- use concepts. theorems and methods to handle questions in analysis and numerical aspects of differential equations and transforms described by the course content,
- use analytical and numerical methods to solve the the differential equations described by the course content, and gain insights into the possibilities and limitiations of methods.
- read and comprehend mathematical text.

Course contents

- Equations: First and higher order ordinary differential equations and systems of these, partial differential equations (e.g. for heat and waves).
- Transforms: Fourier transform, Laplace transform and Fourier series.
- Analytical concepts: Initial value problems, boundary value problems, existence and uniqueness of solutions, autonomous equations, direction fields, phase portraits, solutions curves, oscillation phenomena, general solution, particular solution, stationary/critical points, stability, linearization of systems, the delta function, generalized derivatives.
- Numerical concepts: Apprximation, discretization, convergence, conditional number, accuracy, local linearization, stability, stiff systems, implicit and explicit methods, adaptivity.
- Analytic methods: Integrationg factor, separation of variables, variation of parameters, eigenvalue methods, transforms, spectral methods.
- Numerical methods: Newton's method for non-linear systems, Euler forward, Euler backwards, Runge_kutta methods, finite difference methods, spectral methods, fast Fourier transform (FFT), computational complexity.

Course literature

The course literature will be announced on the course homepage at least four weeks before the start of the course.

Examination

- INLA - Assignments, 5.0 credits, grading scale: P, F
- TEN1 - Exam, 6.0 credits, grading scale: A, B, C, D, E, FX, F

Based on recommendation from KTH’s coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

The examiner decides, in consultation with KTHs Coordinator of students with disabilities (Funka), about any customized examination for students with documented, lasting disability. The examiner may allow another form of examination for re-examination of individual students.

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.