# SF1524 Basic Numerical Methods and Programming 7.5 credits

## Grundläggande numeriska metoder och programmering

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

## Establishment

Course syllabus for SF1524 valid from Autumn 2015

## Grading scale

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

## Education cycle

First cycle

## Main field of study

Technology

## Specific prerequisites

Courses in Linear Algebra and Calculus in one variable (corresponding to SF1624 and SF1625).

## Language of instruction

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

## Intended learning outcomes

The overall goal of the course is to give the students skills in numerical methods and computer programming to make reliable and effective simulations of technical and scientific processes based on mathematical models.

After the course the student should be able to:

- identify different mathematical problems and rewrite them in a form that is suitable for numerical treatment.
- choose an appropriate numerical method for the given problem and motivate the choice of method
- choose an algorithm that leads to efficient computations and implement them in a computer language suited for calculations, e.g. Matlab, using both self-written code and library routines.
- assess the reliability of the result and visualize it
- partition larger problems into suitably sized parts and write well structured and effective programs for these in the chosen computer language.
- solve linear systems of equations and non-linear equations
- do curve fitting
- estimate integrals
- solve simple ordinary differential equations analytically
- solve more complex types of ordinary differential equations numerically
- write computer programs that simulate different solution patterns in systems of differential equations.

## Course contents

Solving problems by subdivision into smaller ones.

Programming in a modern computer language for computations (e.g. Matlab)

Use of mathematical software to solve scientific problems, do numerical experiments and present the solutions.

Basic ideas and concepts in numerical methods: algorithms, computation cost, local linearization, iteration, discretization, stability, convergence.

Assessment of reliability: parameter sensitivity, perturbation estimation.

Numerical methods for non-linear equations and linear systems of equations, integrals, interpolation, least squares method.

Analytical and numerical methods for systems of ordinary differential equations.

## Course literature

Announced no later than 4 weeks before the start of the course on the course web page.

## Examination

- TEN1 - Examination, 3.0 credits, grading scale: A, B, C, D, E, FX, F
- LABC - Laboratory Work, 1.5 credits, grading scale: P, F
- LABB - Laboratory Work, 1.5 credits, grading scale: P, F
- LABA - Laboratory Work, 1.5 credits, grading scale: P, 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.

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

In this course, the code of honour of the school is applied,
see: http://www.sci.kth.se/institutioner/math/avd/na/utbildning/hederskodex-for-studenter-och-larare-vid-kurser-pa-avdelningen-for-numerisk-analys-1.357185

## Other requirements for final grade

A written examination (TEN1).
Laboratory assignments (LABA; LABB, LABC).

## 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.