

**SYLLABUS**

# **Numerical Methods 7.5 credits F7002R**

**Numeriska metoder**

**Course syllabus admitted: Spring 2018 Sp 3 - Present**

**DECISION DATE  
2017-02-15**

# Numerical Methods 7.5 credits F7002R

## Numeriska metoder

### Second cycle, F7002R

Education level	Grade scale	Subject	Subject group (SCB)
Second cycle	G U 3 4 5	Rymd- och atmosfärsvetenskap	Space Technology

## Entry requirements

F0007T Electromagnetic field theory and F0030T Continuum Mechanics. Or, in other words linear algebra, functions of several variables, ordinary and partial differential equations, probability theory, and fourier series. The course treats problem taken from mechanics, electrical circuit theory, electrostatics, thermodynamics, wave theory, fluid mechanics. Knowledge of Legendre and Bessel functions is desirable. Likewise knowledge of computer program MATLAB is desirable.

## Selection

The selection is based on 30-285 credits

## Examiner

Johnny Ejemalm

## Course Aim

The student shall acquire knowledge about different numerical methods that are suitable for treatment or solution of common problems within different application areas of physics. The student shall acquire insight into the problems that may arise when using numerical methods. The student shall in that respect be able to value which solution method, e.g. choice of algorithm, that are suitable for solution of problems within the application areas that are covered by the course.

The student shall be able to apply different solution methods in order to calculate approximate solutions of problems in physics. The student shall be familiar with some computer program as means for numerical analysis and computations. This is shown by performed calculations, written computer code and choice of solution method.

The student shall be able to value the importance of the relationship between truncation errors, round-off errors, and calculation time. This is shown by choice of parameters for solutions.

## Contents

Basics of scientific computing. The importance of truncation errors and round-off errors. Numerical methods for solving mathematical problems that frequently arise in physics, such as ordinary and partial differential equations, linear and non-linear system of equations, curve fit, spectral analysis, stochastic methods as Monte Carlo and wavelets. Numerical methods for analysis of data, such as data generated from spacecraft measurements, or from earthbound instruments. Furthermore some items are included that can differ from year to year, e.g. time series analysis.

## Realization

Each course occasion's language and form is stated and appear on the course page on Luleå University of Technology's website.

Lectures. An important part of the course is assignments, where the students individually shall solve computational problems arising in physics using suitable programming languages such as Matlab.

## Examination

If there is a decision on special educational support, in accordance with the Guideline Student's rights and obligations at Luleå University of Technology, an adapted or alternative form of examination can be provided. Assignments of partly theoretical character and partly of modified or wholly written computer solutions. The results of the assignments are graded with 5, 4, 3 and Failed(U).

## Remarks

Advanced level. Knowledge from this course is applicable in various following courses where physical problems are encountered that are not exactly solvable.

## Overlap

The course F7002R is equal to RYM010

## Literature. Valid from Autumn 2007 Sp 1

Alejandro L Garcia: Numerical Methods for Physics, 2 ed, Prentice Hall, Englewood Cliffs, N.J., 2000. ISBN-10: 0139067442. ISBN-13: 978-0139067440

## Course offered by

Department of Computer Science, Electrical and Space Engineering

## Items/credits

Number	Type	Credits	Grade
0001	Assignment reports	7.5	G U 3 4 5

## Study guidance

Study guidance for the course is to be found in our learning platform Canvas before the course starts. Students applying for single subject courses get more information in the Welcome letter. You will find the learning platform via My LTU.

## Last revised

by Jonny Johansson, HUL SRT 2017-02-15

## Syllabus established

The course plan was accepted by the Dept of Space Science 2007-02-28 and remains valid as from H07.