

SYLLABUS

Numerics for Optimization and PDE 7.5 credits C7005M

Numerik för optimering och PDE

Course syllabus admitted: Autumn 2023 Sp 1 - Present

**DECISION DATE
2021-02-17**

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Numerik för optimering och PDE

Second cycle, C7005M

Education level	Grade scale	Subject	Subject group (SCB)
Second cycle	G U 3 4 5	Teknisk- vetenskapliga beräkningar	Mathematics

Entry requirements

Mathematics including linear algebra and multivariable calculus (e.g. M0029M-M0032M at LTU). Programming skills in Matlab or in some other programming language. Knowledge of basic Numerics (e.g., C0004M or S7013E at LTU)

Selection

The selection is based on 30-285 credits

Course Aim

Using the rubrics below for classifying the aims, the student should, after the course, be able to:

Knowledge and understanding

- explain how different sources of errors affect the accuracy in computations.
- derive computational algorithms based on fundamental techniques such as linearisation, iteration, and discretisation

Skills and abilitie

- use numerical methods and existing software for solving advanced computational problems, such as e.g. optimization problems and partial differential equations
- implement different methods on a computer
- formulate and communicate issues regarding computational problems

Assessment and attitudes

- judge different methods regarding strengths, weaknesses and usability.
- judge the reliability of computed results.

Contents

In the area of continuous optimisation the course consider theory about optimality conditions and deterministic (not stochastic) methods for solving

- Linear optimization problems
- unconstrained nonlinear optimization problems
- nonlinear optimization problems with linear equality constraints

In the area of partial differential equations (PDE) we consider finite difference methods, spectral methods, and finite element methods in order to solve

- time independent PDE in two space variables (elliptic PDE)
- time dependent PDE in one space variables (parabolic PDE)

Realization

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

Lectures and supervision in connection to assignments.. Most part of the studies are performed by working in groups with assignments where different algorithms are implemented and analysed. The implementation of the algorithms is done in Matlab or some other programming environment.

The students will here be trained in understanding and implementing different algorithms and to judge their strengths and weaknesses.. The students are also trained in structuring problems and to communicate computational issues and how to solve them.

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.

The aims with the rubrics "knowledge and understanding" and "assessment and attitudes" are examined by an individual exam with grading scale U G 3 4 5. The goals under the rubric "skills and abilities" are examined by group assignments with grading scale U G#.

Unauthorized aids during exams and assessments

If a student, by using unauthorized aids, tries to mislead during an exam or when a study performance is to be assessed, disciplinary measures may be taken. The term "unauthorized aids" refers to aids that the teacher has not previously specified as permissible aids and that may assist in solving the examination task. This means that all aids not specified as permissible are prohibited. The Swedish version has interpretative precedence in the event of a conflict.

Overlap

The course C7005M is equal to C7004M

Course offered by

Department of Engineering Sciences and Mathematics

Modules

Code	Description	Grade scale	Cr	Status	From period	Title
0001	Exam	G U 3 4 5	4	Mandatory	A17	
0002	Assignments	U G#	3.5	Mandatory	A17	

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 Head Faculty Programme Director Niklas Lehto 2021-02-17

Syllabus established

by Mats Näsström 2017-02-13