Course syllabus

Optimering
Optimization

FMAN60, 6 credits, A (Second Cycle)

Valid for: 2017/18
Decided by: PLED F/Pi
Date of Decision: 2017-04-06

General Information

Main field: Technology.
Elective Compulsory for: I3
Elective for: BME4, D4, E4, F4, F4-bs, F4-fm, F4-r, M4, Pi3-bs, Pi3-fm, Pi4-bg, Pi4-bem
Language of instruction: The course will be given in English on demand

Aim

The aim of the course is to present basic optimization theory, and to give an overview of the most important methods and their practical use.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

• be familiar with and, in his/her own words, be able to describe the optimization algorithms, for problems with and without constraints, encountered in the course, and their properties.
• be familiar with the theory of convex sets and convex functions, and be able to state and derive the most important theorems on convexity.
• be aware of how to make use of convexity in the treatment of an optimization problem.
• be familiar with Kuhn-Tucker Theory and be able to state and derive the most important theorems therein.

Competences and skills
For a passing grade the student must

• be able to demonstrate an ability to solve optimization problems within the framework
of the course.
• be able to demonstrate an ability to handle optimization problems using a computer.
• be able to demonstrate an ability to, in the context of problem solving, develop the
theory somewhat further.
• be able to describe the connections between different concepts in the course,
with proper terminology and in a well structured and logically consistent manner.
• with proper terminology, suitable notation, in a well structured way and with clear logic
be able to describe the solution to a mathematical problem and the theory within the
framework of the course.

Contents
Quadratic forms and matrix factorisation. Convexity. The theory of optimization with
and without constraints: Lagrange functions, Kuhn-Tucker theory. Duality. Methods for
optimization without constraints: line search, steepest descent, Newton methods,
conjugate directions, non-linear least squares optimization. Methods for optimization
with constraints: linear optimization, quadratic programming, penalty and barrier
methods.

Examination details
Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)
Assessment: Written test comprising theory and problems. Two computer exercises and
one project.

The examiner, in consultation with Disability Support Services, may deviate from the
regular form of examination in order to provide a permanently disabled student with a
form of examination equivalent to that of a student without a disability.

Parts
Credits: 6. Grading scale: TH.
Credits: 0. Grading scale: UG.

Admission
Required prior knowledge: Basic university studies in calculus and linear algebra,
including basic theory of quadratic forms.
The number of participants is limited to: No
The course overlaps following course/s: MATC51, FMA051

Reading list
• Lars-Christer Böiers: Mathematical Methods of Optimization. Studentlitteratur, 2010,
• Computer Laboratory Exercises in Optimization. Provided by the department.

Contact and other information
Course coordinator: Studierektor Anders Holst, Studierektor@math.lth.se
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