# FSF3810 Convexity and Optimization in Linear Spaces 7.5 credits

**Konvexitet och optimering i linjära rum**

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

## Establishment

Course syllabus for FSF3810 valid from Autumn 2011

## Grading scale

G

## Education cycle

Third cycle

## Specific prerequisites

A Master degree including at least 30 university credits (hp) in in Mathematics (Calculus, Linear algebra, Differential equations and transform method), and further at least 6 hp in Mathematical Statistics, 6 hp in Numerical analysis and 6 hp in Optimization.

Suitable prerequisity is a Master degree in Applied and Computational Mathematics, including some basic course in optimization, or similar knowledge.

## Language of instruction

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

## Intended learning outcomes

That the student should obtain a deep understanding of the basic concepts and mathematical theory for optimization in infinite-dimensional vector spaces.

After completed course, the student should be able to

- demonstrate a good overview of the various subjects in the course, and how they connect to each other,
- explain and discuss the main concepts and theoretical results in the course,
- rigorously prove some selected main theorems,
- use the concepts and theoreticals results from the course to solve various application problems analytically or (when needed) numerically.

## Course contents

- Basic theory for normed linear spaces.
- Minimum norm problems in Hilbert and Banach spaces.
- Convex sets and separating hyperplanes.
- Adjoints and pseudoinverse operators.
- Gateaux and Frechet differentials.
- Convex functionals and their corresponding conjugate functionals.
- Fenchel duality.
- Global theory of constrained convex optimization.
- Lagrange multipliers and dual problems.
- Local theory of constrained optimization.
- Kuhn-Tucker optimality conditions in Banach spaces.

## Disposition

Lectures

## Course literature

David G Luenberger: Optimization by vector space methods, John Wiley & Sons. Paperback, ISBN: 0-471-18117-X.

## Examination

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.

Homework assignments and a final oral exam.

## Other requirements for final grade

Homework assignments and a final oral exam.

## 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.