



# FSF3563 Optimal Control of Ordinary Partial and Stochastic Differential Equations 7.5 credits

Optimal styrning för ordinära, partiella och stokastiska differentialekvationer

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

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

## Establishment

Course syllabus for FSF3563 valid from Spring 2019

## Grading scale

P, F

## Education cycle

Third cycle

## Specific prerequisites

A Master degree including at least 30 university credits (hp) in Mathematics (including differential equations and numerical analysis).

## Language of instruction

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

## Intended learning outcomes

Goal: to understand and be able to use basic mathematical and numerical methods to solve optimal control problems based on differential equations, which includes that the student after the course can:

- derive the Hamilton-Jacobi-Bellman equation,
- derive the Pontryagin's principle,
- formulate and derive existence and uniqueness of viscosity solutions,
- analyze computational complexity for dynamic programming and Lagrange's method,
- formulate and analyze numerical methods for Hamilton-Jacobi equations,
- formulate applications of optimal control, e.g. for inverse problems,
- analyze and use symplectic numerical methods for Hamiltonian systems.

## Course contents

**Some topics:** dynamic programming, Hamilton-Jacobi-Bellman equations, viscosity solutions, dual problems, computational complexity, numerical methods for Hamilton-Jacobi equations, symplectic methods.

**Some applications:** optimal portfolio (SDE), American options (SDE), catalytic converter (PDE), shape optimization (PDE).

## Disposition

Lectures and seminars

## Course literature

L.C. Evans, Partial Differential Equations, Oxford

Lecture notes on SDE, PDE and numerics

## Examination

- INL1 - Assignment, 7.5 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.

Homework

Computer lab

Written exam

## Other requirements for final grade

Home assignments completed

Written exam completed

## 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.