



# EL2320 Applied Estimation 7.5 credits

## Tillämpad estimering

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 EL2320 valid from Autumn 2013

## Grading scale

A, B, C, D, E, FX, F

## Education cycle

Second cycle

## Main field of study

Electrical Engineering

## Specific prerequisites

For single course students: 120 credits and documented proficiency in English B or equivalent.

## Language of instruction

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

## Intended learning outcomes

The overall goal of the course is to give the participants theoretical as well as practical skills and experience in estimation. The course will start from a number of concrete examples to motivate the need for various filtering techniques such as Kalman filters and particle filters. After completing the course the participants should:

- The student will be able to: describe the parts of a Bayesian recursive filter in terms of the underlying probabilities, compare and contrast different estimation techniques, and select and apply appropriate techniques to problems.
- The student will have reflected on the relationship between measurement uncertainty, probability theory and estimation methods.
- The student will have gained experience in finding information from current scientific literature including recently published journal articles. As well as presentation of results in well structured scientific reports.

## Course contents

The course focuses on giving the participants practical experience in using different estimation techniques on real problems. Examples used in the course are for example from navigation with mobile robots. The following will be covered in the course: Observability, the Markov assumption, data association, estimation techniques such as Kalman filter, extended Kalman filter, particle filter, Rao-Blackwellized particle filter, Unscented Kalman Filter, Covariance Intersection.

## Disposition

There are 12 lectures. Both theory and practice of estimation will be covered. Getting practical skills in anything requires you to get hands-on experience and as such the work between the lectures will be very important.

Two labs solved individually cover the Kalman filter and the particle filter.

Students can work in pairs with the final project but each will hand in a separate report.

## Course literature

The official course book is "Probabilistic robotics" by Thrun, Burgard and Fox, The MIT Press, ISBN 0-262-20162-3 covers most of the material in the course from a robotics points of view. Lectures notes will also be made available. This course is at advanced level so some of the material will be in the form of research publication. The students are assumed able to research for additional material to solve the project assignment.

## Equipment

No special equipment needed, you only need access to a computer

## Examination

- PRO1 - Project, 2.0 credits, grading scale: P, F
- PRO2 - Project, 2.0 credits, grading scale: P, F
- TEN1 - Examination, 3.5 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.

The basic part of the examination in the course consists of two lab assignments, an exam and a project. These are credited as,

PRO1: 2.0hp

PRO2: 2.0hp

TEN: 3.5hp

Each of these will be reported to the system with a P/F grade and passing them all means that the student has passed the course.

This project assignment can be completed in groups of two students but each needs to write a separate report .

The final grade is given as A-F and is based on the performance on the exam and the project work (consisting of a mandatory part for passing and an optional part for higher grades). Only doing the mandatory part of the project thus gives a final grade of half the exam grade.

## Other requirements for final grade

To get a passing grade in the course the students need to pass the mandatory part of the project assignment and the 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.