



## Course syllabus

Faculty Board of Science and Engineering

School of Computer Science, Physics and Mathematics

2ED013 Reglerteknik, 7,5 högskolepoäng

2ED013 Automatic control, 7.5 credits

**Main field of study**

Electrical Engineering

**Subject Group**

Electrical Engineering

**Level of classification**

First Level

**Progression**

G2F

**Date of Ratification**

Approved 2009-12-01

Revised 2010-11-26 by School of Computer Science, Physics and Mathematics.

Revision made for prerequisites and course evaluation.

The course syllabus is valid from autumn semester 2011

**Prerequisites**

Electrical engineering 120 credits incl. Analogue signals and systems 7.5 credits (1ED062) or the equivalent.

## Objectives

Upon completion of the cours the student should:

- be able to make a mathematical model for a simple dynamical system
- be able to make a stability analysis for an open system and for a closed control system
- understand and be able to make specifications for a control system in both the time domain and in the frequency domain
- be able to make reasonable estimates of a transient response and the steady-state response based on the pole-placement of the closed system or on the Bode diagram for the open system
- master the design methods: pole-placement, lead-lag compensation, feed-forward and cascade compensation
- based on a block diagram be able to simulate the behavior of the system in the time domain. Process parameters should be accessible and possible to alter.

Different process variables should be possible to study.

## Content

All treated dynamical systems are time continuous and time invariant. With a few exceptions, they are all linear.

Introduction to automatic control: history, examples of control system and basic concepts of automatic control.

Modeling of dynamical system using time invariant ordinary differential equations. Linearization, state-space model, weighting function, Laplace transform, transfer function, Nyquist- and Bode diagram.

Analysis of dynamic system. Concepts of stability. Analysis of stability using Root locus, Routh-Hurwitz criterion, the principle of the argument and the Nyquist criterion. Gain margin and phase margin.

Synthesis of control systems. Specifications, pole-placement, lead-lag compensation, PID-controller, feed forward, cascade compensation, robustness, sensitivity for disturbances and changes in parameters.

## Type of Instruction

Teaching consists of lectures, practical work and laborations. Practical work is carried out in groups. Attendance at some activities may be mandatory.

## Examination

The course is assessed with the grades U, 3, 4 or 5.

On request, students may have their credits translated to ECTS-marks. Such a request must be sent to the examiner before the grading process starts.

Assessment of the student's performance is made through written examination and/or assignments which are presented orally and/or in written form. The assessment method is decided at the start of the course.

Students who do not pass the regular examination are given the opportunity to do a resit examination shortly after the regular examination.

## Course Evaluation

A course evaluation will be carried out at the end of the course in accordance with the guidelines of the University. The result of the course evaluation will be filed at the department.

## Other

Upon request, a Swedish University degree will be issued upon successful completion of the full demand for that degree.

Students who receive a passing grade in the course may download a course certificate through the Student Portal. Otherwise they may request a course certificate from the school secretary.

## Required Reading and Additional Study Material

### Required reading

Lennartson Bengt, *Reglerteknikens grunder*, Studentlitteratur, 2000, Edition 4, 2002. Pages 513.

### Required reading

**This literature will be used if the course is given in English.**

G. F. Franklin, J. D. Powell, and A. Emami-Naeini. *Feedback Control of dynamic systems*. Addison-Wesley, sixth edition, 2009. Pages 340.