IL2246 Introduction to Analog and Digital Electronics 7.5 credits

Introduktion till analog och digital elektronik

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

Establishment

The official course syllabus is valid from the autumn semester 2025 in accordance with the decision by the Faculty Board: J-2024-2256. Date of decision: 2024-10-08

Grading scale

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

Education cycle

Second cycle

Main field of study

Electrical Engineering

Specific prerequisites

Knowledge of mathematics covering 20 higher education credits, in the form of completed courses.

Knowledge of physics covering 30 higher education credits, in the form of completed courses.

Language of instruction

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

Intended learning outcomes

After passing the course, the student should be able to

- Describe voltage-current diagrams and circuit models for the diodes and transistors of bipolar and MOS type
- design and analyze simple amplifier circuits and calculate large and small signal characteristics
- calculate basic amplifier parameters such as raw gain, input/output impedance and cut-off frequencies
- determine the transfer function of frequency-dependent amplifier circuits and be able to draw their Bode diagrams (magnitude and phase curve) and calculate cut-off frequencies
- analyze operational amplifier couplings with feedback
- analyze CMOS gates at the transistor level and determine their logic function
- analyze and design simple combinatorial and sequential logic circuits that implement a given function
- use circuit simulation tools to analyze analogue and digital circuits
- physically implement basic analogue and digital circuits, and evaluate them through electrical measurements

in order to be prepared for advanced courses in the field.

Course contents

Analogue electronics

- Amplifiers and amplifier parameters: basic gain, linearity, input/output impedance, cut-off frequencies, sensitivity, noise.
- Semiconductor components: diode and transistor - characteristics and circuit models.
- Amplifier connections, design/analysis: biasing, common emitter step, large/small signal analysis, emitter follower (common-collector) step.
- Multi-transistor couplings: cascading, Darlington circuit, current mirrors.
- Frequency-dependent: Bode diagrams, breakpoints, cut-off frequencies, transistor capacitances and common-emitter step cut-off frequencies.
- Operational amplifiers (OP): ideal OP, OP circuits, structure, feedback, stability, oscillators.
- Circuit simulation and amplifier circuit design and measurements.

Digital Electronics

- Binary arithmetic, Boolean algebra and Boolean functions.
- Logical operations, gate logic.
- Basic CMOS technology.
- Combinatorial function blocks and construction of combinatorial circuits. Latches and flip-flops
- Counters, synchronous sequential circuits, Mealy type and Moore type state machines.

Examination

- LAB1 - Laboratory Work, 3.0 credits, grading scale: P, F
- TEN1 - Written Exam, 4.5 credits, grading scale: A, B, C, D, E, FX, 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.

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

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.