IL224V Semiconductor devices with applications 4.5 credits

Halvledarkomponenter och tillämpningar

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

The official course syllabus is valid from the springsemester 2025 in accordance with the decision from the director of first and second cycle education: J-2024-1629.Date of decision: 2024-06-11

Grading scale

P, F

Education cycle

Second cycle

Main field of study

Electrical Engineering

Specific prerequisites

Knowledge of material properties (especially in solid state physics) and modern physics, 10 higher education credits, or knowledge in electrical circuit science and analogue electronics, including the use of transistors/CMOS, 10 higher education credits.

Course from upper secondary school corresponding to English B/6, according to the Swedish upper secondary school system.

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 the function and the application areas for the pn-diode, the MOS-transistor and common types of memory cells and some kind of semiconductor sensor
- use current-voltage relations to model semiconductor components
- compare experimental measurement results on the included components with appropriate theory
- describe the basic properties for CMOS inverters and how these are used to implement integrated circuits.
- give an account of the most important sustainability aspects in production of modern microelectronics
- give an account of the most important properties of the semiconductor material silicon and another material that is used in optoelectronics and power electronics.

Course contents

Semiconductor components, based on pn-junctions and MOS structures, including the MOS transistor, pn and Schottky diodes, different types of memory cells, solar cells, photodiodes and light-emitting diodes. Overview of the most important semiconductor materials with a focus on the properties of silicon and some examples in e.g. optoelectronics and power electronics.

- In the theoretical part of the course, we retrieve basic current-voltage relations that are used to model semiconductor components in applications such as integrated circuits or simple analogue electronics.
- In the practical part of the course, simple labs on the components that have been introduced in the theoretical part are carried out.
- The process flow in the production of modern micro- and nano electronics, above all CMOS, including sustainability aspects such as energy consumption and finite resources.
- Basic analysis of power consumption and gate delay in CMOS based circuits.
- Overview of the development of so-called technology nodes for advanced CMOS.

Examination

- LAB1 - Laborations, 1.5 credits, grading scale: P, F

- TEN1 - Take-home exam, 3.0 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.

LAB1 is a practical lab that can be replaced with a computer-based lab for students who want follow the course only at distance.

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.