FEK3250 Microsystem Technology for PhD Students 8.0 credits

Mikrosystemteknik för forskarstuderande

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 FEK3250 valid from Spring 2019

Grading scale

P, F

Education cycle

Third cycle

Specific prerequisites

The course is open for PhD students at KTH.

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 this course is to introduce engineering students to the world of microengineering, i.e. the world of technical components and systems with feature sizes in the range sub-millimetre down to 100 nm. The area is often also referred to as a “MEMS” – Micro Elcreomechnical Systems. The following aspects will be addressed in particular: basic physical principles used for sensing and actuation in microtechnology, methods for microfabrication, the design and operation of the most commonly used micro-components and systems, and the use of microtechnology in specific application areas.

After following the course, the students will have obtained the following skills in particular:

With respect to

- the basic physical sensing and actuation principles, including microfluidics,
- silicon microfabrication technology, and
- the most relevant types of optical, resonant, inertial, flow, pressure, radiation and thermal microsensors, as well as microfluidic components and RF and telecom devices,

be able to

- give an overview of the most commonly used methods and techniques
- explain how these work and can be implemented
- compare their advantages and drawbacks
- use their knowledge to make a structured and educated approach to engineering challenges involving microsystem technology.

With respect to the specific application fields of medical, automotive, biotechnical, optical and telecommunication systems

be able to

- explain the potential of microsystem technology in terms of size, cost and/or performance.

In addition, the students will gain deeper insight by performing practical work in a clean-room environment and by making a performance evaluation of a microsystem.

With respect to

- the MEMS research field

be able to

- analyse and explain research articles.

Course contents

A lecture series which provides the students with both an overview of different aspects of microengineering and with a deeper insight in the specific techniques for the most common application areas.

- The first set of lectures deal with an introduction to the field, the fabrication of microsystems and the fundamental physical effects utilized within microengineering.
- Thereafter second set of lectures give a detailed overview of microsensors for quantifying position, tension, acceleration, temperature, pressure, and flow.

- The last set of lectures illustrate the use of microsystems in various applications (i.e. medical systems, automotive systems, etc).
- Moreover, a guest lecturer from industry describes micromechanical sensors and gives insight into how microsystems can be commercialized.
- Yet another guest lecturer will give an introduction to the related emerging field of nanotechnology.

Homework assignments will be handed out in relation to the lectures in order to stimulate further studies of the different topics of the lectures. The home-works will be corrected and the result will determine the course grade.

A mandatory industry site visit will take place at a company fabricating products based on microsystem technology.

Project laborations including clean-room based manufacturing and evaluation of microsystem technology component.

A presentation in seminar form made by the student covering three research articles in the field MEMS relating to the course content. The articles studied should be decided together with the course responsible.

Disposition

Lecture series and homework assignments in relation to the lectures. Two course laborations and one study visit. Self-studies of three selected research articles.

Course literature

Course material handed out at lectures. Research articles.

Examination

- EXA1 - Examination, 8.0 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.

Other requirements for final grade

To pass the course, the following is required

- Mandatory presence in at least 80% of the lectures,
- a clean-room laboration
- passed all home-work assignments, including the written report on the laboration

- a mandatory industry site visit
- passed presentation of research articles

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.