FJQ3320 Micro and Nanosystems - applied technologies outside the cleanroom 15.0 credits

Mikro och Nanosystem - tillämpade teknologier utanför renrummet

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

Establishment

Course syllabus for FJQ3320 valid from Autumn 2018

Grading scale

P, F

Education cycle

Third cycle

Specific prerequisites

The course content is intended for PhD students in the field of micro- and nanosystem technology, material science, and similar study directions.

Language of instruction

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

Intended learning outcomes

After the completed course the student shall be able to:

- Analyze the requirements on design, fabrication and evaluation of micro and nanosystems in relation to the research project
- Describe the working principle and limitations of the fabrication or characterization methods for micro and nanosystems
- Correlate the micro- and nanosystem requirements with the limitations of the fabrication and characterization methods to motivate experimental designs
- Independently carry out the fabrication and characterization methods and develop protocols optimized for the research project
- Do a risk assessment of the processes and methods taught in the course including handling and disposal of chemical and biological material
- Carry out a Life Cycle Analysis (LCA) of materials used in the micro and nanofabrication and characterization methods
- Analyze and reflect over the sustainability aspects of the chosen methods and processes

Course contents

This course gives practical training on instruments and methods used to design, fabricate and evaluate micro and nanosystems outside clean-room settings. The course requires self-studies of the theoretical principles of the instruments and methods covered in the practical training. Training on risk assessment of the instruments and methods is included as a part of the course. Life-cycle analysis (LCA) of materials and systems related to micro and nanofabrication will also be covered. The course content is intended for PhD students in the field of micro- and nanosystem technology, material science, and similar study directions.

Disposition

The course is organized as practical demonstrations and training in the lab and discussion sessions with the examiner.

Course literature

NA

Examination

- EXA1 - Examination, 15.0 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.

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

To complete the course with the grade passed the students must have reached the learning outcomes on a number of methods and instruments with a sum of credits (see table 1 for examples, more methods and instruments can be added) equal to or more than fifteen. Each student must be able to carry out a risk assessment and LCA according to the intended learning outcomes. In addition, at least one method must be a pattern definition technique and at least two methods must be characterisation methods.

Other requirements for final grade

Table 1: Example of included instruments and methods

Note that these instruments and methods are examples and others can be added after approval of the examiner.

Instruments and methods:

Basic laboratory techniques

Risk assessment - 1.5

Life cycle analysis (LCA) - 1.5

Basic cell biology techniques including sterility techniques - 1.5

Basic microbiology techniques - 1.5

Pattern definition techniques

Fs-laser patterning - 1.5

Soft lithography (PDMS) - 0.75

Non-cleanroom photopatterning (OSTE) - 1.5

RIM - 1.5

3D printing - 1.5

Cutting plotter - 0.75

Physical surface engineering (Oxygen plasma chamber) - 0.5

Surface characterisation methods

SEM - 1.5

AFM - 1

Goniometry - 0.5

FT-IR - 1.5

White light interferometer - 0.5

Functional characterisation method/tool

Confocal microscopy - 1.5

Fluorescence microscopy - 0.75

TEM - 2

DNA and RNA purification and quantification - 1.5

Gene expression analysis - 1.5

Protein quantification (ELISA and similar) - 1.5

Drug Doses and quantification approaches in micro/nanosystems - 1.5

Mass spectrometry - 1.5

Basic Electrochemical analytical methods - 1.5

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.