



SK2770 Introduction to Nanotechnology 5.0 credits

Introduktion till nanoteknik

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 SK2770 valid from Autumn 2018

Grading scale

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

Education cycle

Second cycle

Main field of study

Engineering Physics

Specific prerequisites

Bachelor's degree in Physics, Electrical Engineering, Materials science, Chemistry or equivalent, including courses in mathematics corresponding to at least 20 ECTS credits and courses in physics corresponding to at least 30 ECTS credits.

Language of instruction

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

Intended learning outcomes

Upon successful completion of the course, students should be able to:

- Describe developments in Nanotechnology and it is going to affect our future life.
- Describe materials and their properties at the atomic and nanometer level and the intimate relationship between material scale (nanostructure) and the properties/functionality of materials
- Describe nanomaterials based on their dimensionality.
- Describe the increase in surface to volume ration with reducing size
- Explain the importance of the reduction in dimensionality, and its relationship to materials properties.
- Describe solution and vapor growth techniques of 1D-2D nanostructures
- Describe fundamentals of nucleation growth
- Describe self-assembly, surfaces and interfaces in nanotechnology
- Give examples on size-dependent phenomena.
- Explain top-down and bottom-up approaches for Nanomaterial fabrication
- Describe and discuss Nanotechnology tools
- Describe societal impacts and ethics in Nanotechnology
- Explain underlying principles in products using nanotechnology
- Systematically solve scientific problems related specifically to nanomaterials using conventional scientific and mathematical notations

Course contents

Nanotechnology brings together knowledge and skill sets crucial to emerging technologies complementing backgrounds in physics, chemistry, materials science, electrical engineering, mechanical engineering, applied sciences, and chemical engineering. This course intends to provide advanced introduction discussing the paradigm shifts in the scientific frameworks from physics, chemistry, biology and materials sciences. The course will introduce underlying principles and applications of the emerging field of nanotechnology.

This course builds around relevant knowledge from classical disciplines of physics, chemistry and biology to provide a fundamental understanding of the multidisciplinary Nanotechnology field of study. The course aims provide sufficient knowledge to the learner in order to broadly understand and appreciate the scientific and technological developments in nanotechnology. During the course students are expected to acquire basic knowledge of the physical phenomena, theoretical concepts and experimental techniques behind the ability to observe, fabricate and manipulate individual structures in the nanometer scales. Another aim of the course is to familiarize with the trends of the top-down approaches of materials fabrication especially in microelectronics and micromechanics with the bottom-up approaches from chemistry/biology; a development that is creating new and exciting cross-disciplinary technologies. Introduction to the past achievements and the current

cutting edge scientific and technology developments in the nano-world will be presented to demonstrate the far-reaching potential of nanoscience and industrial applications of nanotechnology considering the ethics and societal impacts. A final goal is to give you an insight into complete systems where nanotechnology can be used to improve our everyday life.

The course gives an introduction to quantum confinement effects in nanosolids in 0D, 1D, and 2D. Solution and vapor growth techniques of 1D-2D nanostructures.

Course literature

- Introduction to NanoScience, (CRC Press of Taylor and Francis Group LLC), May 2008, 856pp, ISBN-13: 9781420048056, G. Louis Hornyak, Joydeep Dutta, Harry F. Tibbals and Anil K. Rao
- Lecture notes and reference literature.

Examination

- TEN1 - Oral exam, 5.0 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.

Other requirements for final grade

Grade A-E on the exam, 5.0 hp

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.