

Nano Physics

Programme course

6 credits

Nanofysik

TFYY54

Valid from: 2017 Spring semester

Determined by

Board of Studies for Electrical
Engineering, Physics and Mathematics

Date determined

2017-01-25

Main field of study

Applied Physics, Physics

Course level

Second cycle

Advancement level

A1X

Course offered for

- Applied Physics and Electrical Engineering, M Sc in Engineering
- Physics and Nanoscience, Master's programme
- Materials Science and Nanotechnology, Master's programme
- Applied Physics and Electrical Engineering - International, M Sc in Engineering

Entry requirements

Note: Admission requirements for non-programme students usually also include admission requirements for the programme and threshold requirements for progression within the programme, or corresponding.

Prerequisites

Semiconductor Physics, Nanotechnology

Intended learning outcomes

The aim of this course is to give an introduction to the physics at the nanometer scale. The participants of the course obtain basic understanding of the principles, fabrication and characterization methods, and application aspects of nanoscience and nanotechnology. This implies that the students should:

- understand the fundamental physical principles, which govern properties of the condensed matter and in particular the role of dimensionality on the mechanical, thermal, optical, electrical and magnetic properties of materials
- understand the physical basis of new phenomena that appear when the linear dimension of an object or device shrinks below a micrometer
- be familiar with the methods for fabrications of nanostructures
- understand and be able to explain the principles of newly characterization techniques for imaging and analysis of nanostructures and nanomaterials
- understand and be able to explain the principles of operation of nanoelectronic and nanophotonic devices
- become familiar with the whole concept of nanoscale science and technology and be able to apply their knowledge for understanding further developments in this rapidly emerging area.

Course content

A. Introduction to nanophysics and nanotechnology – scaling laws and limits to smallness; quantum nature of nanoworld; nano fabrication (top-down and bottom-up process); nanoscopy (electron microscopy, atomic force microscopy, scanning tunneling microscopy)

B. Properties and application of dielectric and metal nanostructures - individual nanoparticles and nanoclusters; nanostructured materials; carbon nanostructures; nanomagnets.

C. Properties and application of semiconductor nanostructures - fabrication of semiconductor nanowires and quantum dots; electronic and optical properties (2D and 3D quantum confinement); optical spectroscopy of semiconductor nanostructures (local probe techniques); quantum dots nanowire- and quantum-dot-based electronic and photonic devices.

Teaching and working methods

Lectures and laboratory exercises

Examination

UPG2	Assignments	2 credits	U, G
LAB1	Laboratory Work	1 credits	U, G
PRA2	Project work	3 credits	U, 3, 4, 5

Grades

Four-grade scale, LiU, U, 3, 4, 5

Department

Institutionen för fysik, kemi och biologi

Director of Studies or equivalent

Magnus Johansson

Examiner

Plamen Paskov

Course website and other links

<http://www.ifm.liu.se/undergrad/fysikgtu/coursepage.html?selection=all&sort=kk>

Education components

Preliminary scheduled hours: 40 h

Recommended self-study hours: 120 h

Course literature

Additional literature

Books

Ch. Poole Jr., F. J. Owens, (2003) *Introduction to nanotechnology* John Wiley & Sons

E. L. Wolf, (2004) *Nanophysics and nanotechnology: An introduction to modern concepts in nanoscience* Wiley-VCH

Eds. R. W. Kelsall, I. W. Hamley and M. Geoghegan, (2005) *Nanoscale science and technology* John Wiley & Sons

Common rules

Regulations (apply to LiU in its entirety)

The university is a government agency whose operations are regulated by legislation and ordinances, which include the Higher Education Act and the Higher Education Ordinance. In addition to legislation and ordinances, operations are subject to several policy documents. The Linköping University rule book collects currently valid decisions of a regulatory nature taken by the university board, the vice-chancellor and faculty/department boards.

LiU's rule book for education at first-cycle and second-cycle levels is available at http://stydokument.liu.se/Regelsamling/Innehall/Utbildning_pa_grund-_och_avancerad_niva.