Reg No: HNT 2014/83:12

Faculty of Health, Science and Technology
Physics

Syllabus

Course Approval
The syllabus was approved by the Faculty Board of Health, Science and Technology on 4 June 2014 , and is valid from the Autumn semester of 2014 at Karlstad University. It replaces the former syllabus Approved on 26 November 2008, Reg No 2008/9:31 and on13 March 2012 Reg noFAK2 2012/32:4.

Course Code: CBGB06
Nanoscience I, 7.5 ECTS Credits
(Nanovetenskap I, 7.5 Swedish credit points)
Degree Level: Bachelor
Progressive Specialisation: G2F (First cycle, has at least 60 credits in first-cycle course/s as entry requirements)

Language of Instruction
Swedish or English.

Prerequisites
Mathematics 30 ECTS credits, including courses in calculus and linear algebra, and Physics 30 ECTS credits, including courses in electricity, wave physics, quantum physics and thermodynamics.

Major Field of Study
FYA (Physics), TKA (Engineering Physics)

Learning Outcomes

Upon completion of the course students should be able to:

- present an overview of the various areas of nanoscience,
- explain some basic phenomena appearing on the nanoscale in physics and chemistry,
- describe the most important methods for characterizing nanostructures, and choose an appropriate method for a certain investigation,
- describe the most important methods for the synthesis of nanostructures, and choose method depending on the need for a certain structure,
-give examples of and analyze applications of nanotechnology in the areas of materials science, electronics and computer science, energy and environmental technology, and medicine,
- present and assess how nanoscience affects the development of society and how the use of nanotechnology can affect life and environment,
- seek and critically find literature about research on nanoscience,
- plan, collect and present, both orally and in writing, the results of a minor investigation to a group of colleagues with similar basic knowledge.

Content and Form of Instruction

Instruction is in the form of lectures, seminars, group work and laboratory work. Attendance is mandatory for all laboratory sessions.

Areas treated in the course:

- Foundations of Nanoscience: What is nano? Basic physical properties and phenomena in nanometer-sized and lowdimensional structures.
- Tools of Nanoscience: Experimental methods for the characterization of nanostructures; spectroscopy, microscopy and manipulation.
- Nano particles: metals, semi-conductors and molecular materials.
- Nanomaterials: Carbon-based: fullerenes, carbon nanotubes, grapheme and organic molecules and polymers.
- Nanomaterials: Ordered and unordered composites: Modifying material by adding nanoparticles to change properties; mechanical, electronical, optical and magnetical.
- Synthesis of isolated nanoparticles and nano materials: quantum wells, quantum wires, quantum dots, with top-down and bottom-up methods.
- Nanoelectronics and nanooptics: single-electron electronics, MRAM, quantum computers, photonic crystals, nanolasers, NEMS.
- Nanotechnology and energy applications: solar cells and fuel cells.
- Nanotechnology and environment applications: catalysis and purification.
- Nanoscience and medical applications: lab-on-a-chip, biosensors, nanoparticles for diagnosis and drug dosage.
- Applications of nanotechnology, e.g. single-electron transistor, catalysis, NEMS, solar cells, molecular electronics, functional materials, medical diagnosis and therapy.
- Market for nanoscience inventions and companies.

Reading List

See separate document.

Examination

Assessment is based on written and oral exams, hand-in assignments, laboratory reports and written and oral presentations of projects.

Grades

Engineering students are awarded one of the grades Fail (U), Pass (3), Some Distinction (4), or Distinction (5) in the examination of the course. Other students are awarded one of the grades Fail (U), Pass (G), or Distinction (VG) in the examination of the course.

Quality Assurance

Follow-up relating to learning conditions and goal-fulfilment takes place both during and upon completion of the course in order to ensure continuous improvement. Course evaluation is partly based on student views and experiences obtained in accordance with current regulations and partly on other data and documentation. Students will be informed of the result of the evaluation and of any measures to be taken.

Course Certificate

A course certificate will be provided upon request.

Additional Information

Students who enrolled before 1 July 2007 will complete their studies in accordance with the requirements of the earlier admission. Upon completion students may request degree and course certificates to be issued under the current ordinance if they meet its requirements.

The local regulations for studies at the Bachelor’s and Master’s levels at Karlstad University stipulate the obligations and rights of students and staff.

The course is a required course for the Master of Science in Engineering programme, engineering physics

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