



Faculty of Technology and Science  
Physics

## Syllabus

### Course Approval

The syllabus was approved by the Faculty Board of Technology and Science on 13 March 2012, and is valid from the Autumn semester of 2012 at Karlstad University. It replaces the former syllabus approved on 26 November 2008, Reg No 2008/9:31.

**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

For admission to the course knowledge corresponding to 30 ECTS credits Mathematics, including courses in Calculus and Linear Algebra, and 30 ECTS credits Physics, including courses in Electricity, Modern Physics and Solid State Physics, is required.

### Major Field of Study

### 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 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 on and analyze some applications of nanotechnology in the areas of materials science, electronics and computers, 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 shorter investigation to a group of colleagues with similar basic knowledge

### Content and Form of Instruction

Instruction is given in the form of lectures, seminars, group work and laboratory work.

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
- Nanomaterials: Carbon-based: fullerenes, carbon nanotubes, graphene and organic molecules and polymers
- Nanomaterials: Composites: Modifying material by adding nanoparticles to change properties; mechanical, electrical, optical and magnetical,
- Synthesis of isolated nanoparticles and low-dimensional structures on surfaces, 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
- Nanoscience and medical applications: lab-on-a-chip, biosensors, nanoparticles for diagnosis and drug release,
- Applications of nanotechnology, e.g. single-electron transistor, catalysis, NEMS, solar cells, molecular electronics, functional materials
- Market for nanoscience inventions and companies.

## Reading List

See separate document.

## Examination

Examination is in the form of written or oral tests, hand-in assignments and oral presentations.

## 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 assessment is based on student views and experiences as reported in written course evaluations and/or group discussions. Students will be informed of the result of the evaluation and of the 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 an elective course in the Master of Science in Engineering programme, broad curricular base.