Faculty of Science

KEMM47, Chemistry: Unifying Concepts in Nanoscience - Size Effects and Self-assembly, 15 credits

Kemi: Grundläggande fenomen i nanovetenskap - effekter av storlek och självorganisation, 15 högskolepoäng

Second Cycle / Avancerad nivå

Details of approval

The syllabus was approved by Study programmes board, Faculty of Science on 2008-04-29 to be valid from 2008-07-01, autumn semester 2008.

General Information

The course is an elective second-cycle component of a degree of Master of Science (120 credits) specialising in Chemistry or Organizing Molecular Matter.

Language of instruction: English and Swedish
When necessary, the entire course is taught in English.

Main field of studies	*Depth of study relative to the degree requirements*
Chemistry	A1N, Second cycle, has only first-cycle course/s as entry requirements
Organizing Molecular Matter	A1N, Second cycle, has only first-cycle course/s as entry requirements

Learning outcomes

The aim of the course is to provide students with knowledge of the special biological, chemical and physical properties of nanosystems and a description of specific nanosystems and nanophenomena based on classical disciplines such as thermodynamics and quantum mechanics.

On completion of the course, the students are expected to be able to

- describe from a broad perspective the basic theory and methods of nanoscience and the scientific issues addressed by nanoscience

- account for the difference between nanosystems and atomic or bulk systems by giving specific examples from biology, chemistry and physics
- describe and use the basic theory of self-organisation and describe key examples of self-organisation
- use simple models (e.g. particle in a box, molecular orbitals) to describe the electronic structure of dispersed and solid nanosystems
- use simple models and examples to describe how the electronic structure of nanosystems is affected by electron-electron interaction (charge, spin) and connection to vibrations
- explain electric conductivity through nanosystems and identify different regimes (ballistic, coulomb blocking etc)
- explain the biological, physical and chemical properties of functional nanosystems based on model examples introduced on the course
- independently search for information in addition to the course literature
- critically assess and summarise research articles
- write well-structured project reports that summarise, explain and analyse experimental and/or theoretical work in nanoscience
- present their own results in an oral presentation and actively participate in scientific discussions

Course content

The course deals with the physical and chemical foundations of the special properties of nanosystems and includes: size effects, fluctuations, self-organisation, micelles, nanoparticles, chemical, biological, electrical, magnetic and optical properties of molecular and fixed nanostructures.

Course design

The teaching consists of lectures, exercises, independent study and paper writing.

Assessment

The assessment is based on an independent paper using scientific articles and an oral exam.

Subcourses that are part of this course can be found in an appendix at the end of this document.

Grades

Marking scale: Fail, Pass, Pass with distinction.
For a grade of Pass on the whole course, the student must have passed the exam and the paper.
The grades awarded for the exam are Pass with Distinction, Pass and Fail. The grades awarded for the compulsory components are Pass and Fail.
The final grade is determined by the grade for the exam.

Entry requirements

To be admitted to the course, students must meet the general entry requirements for higher education and requirements for English proficiency corresponding to English 6 from Swedish upper secondary school, and have passed 90 credits in science courses including courses equivalent to:

- KEMA00 General and Analytical Chemistry 7.5 credits, KEMA01 Organic Chemistry- Basic Course 7.5 credits, KEMA02 Inorganic Chemistry- Basic Course 7.5 credits and KEMA03 Biochemistry- Basic Course 7.5 credits or

KEM101 Chemistry- Basic Course 1 15 credits and KEM102 Chemistry- Basic Course 2 15 credits or
KEM111 Chemistry for Environmental and Biological Sciences- General Course 1 15 credits, and KEM122 Chemistry for Environmental and Biological Sciences- General Course 2 15 credits and

- KEMB09 Physical Chemistry- Basic Course 15 credits or KEM103 Chemistry- Basic Course 3 15 credits,
- KEMB08 Molecular Interactions and Structure 15 credits or KEM016 Physical Chemistry

15 credits/KEMB19 Physical Chemistry 15 credits, and

- one of courses MATA01 Mathematics for Scientists 1 15 credits, MATA11 Mathematics 1 Alpha 15 credits, MAT015 Mathematics for Scientists 1 15 credits or MAT131 Mathematics 1 Alpha 15 credits.

Students also satisfy the entry requirements if they meet the general entry requirements for higher education and have passed courses equivalent to

- 90 credits in Physics including FYSA31 Physics 3: Modern Physics 30 credits or FYS023 Physics 3: General Course 30 credits and
- 30 credits in mathematics

or

- 60 credits in chemistry, 60 credits in physics and 60 credits in mathematics

Students who have obtained the equivalent knowledge by other means may also be admitted to the course.

Subcourses in KEMM47, Chemistry: Unifying Concepts in Nanoscience - Size Effects and Self-assembly

Applies from H08

0801 Unifying Concepts in Nanoscience, 15,0 hp
Grading scale: Fail, Pass, Pass with distinction
0802 Unifying Concepts in Nanoscience, Compulsory Elements, 0,0 hp
Grading scale: Fail, Pass