Nanotechnology – Sustainability Challenges and Social Impact

Single subject course

7.5 credits

Nanoteknologi - hållbarhetsutmaningar och samhällsinverkan

ETESX3

Valid from: 2018 Spring semester

Determined by
Board of Studies for Chemistry, Biology and Biotechnology

Determining date
Main field of study

Physics, Applied Physics

Course level

First cycle

Advancement level

G1X

Entry requirements

To meet the general entry requirements, students must have completed 1 year full-time studies (passed 60 ECTS credits or equivalent) from one of Linköping University's partner universities upon application.

Intended learning outcomes

The overall aim of this course is to give students an introduction how the advanced technology can be realized at nanometer-scale, and the impact on the global market and society for sustainable development. The course will explore the recent development of nanotechnology in several emerging fields for sustainability. Some particular societal and business perspectives related to entrepreneurship, commercialization, challenges and the translation from early innovation stage to market will be then addressed. The course will also discuss the benefits and risks of nano-products, and will look at how nanotechnology may have a significant impact on the sustainable development of society.

Course content

The course intends to give students a broad perspective on this quickly developing area of science and technology, without becoming embroiled in details of the complicated scientific principles and mathematics. Lectures will cover the following aspects:

What is Nanotechnology, and do people need it?

- Size matters – A general introduction on the definition of nanotechnology as well as the problems expected to solve by nanotechnology for the sustainability
challenges of the future development

- The fundamental science behind nanotechnology
- The development of tools for synthesis and characterizations of materials and devices at the scale of nanometer

Emerging applications of nanotechnology – Opportunities and challenges

- Faster and smarter electronics using nanometer-sized and structured materials and devices, and future quantum computers
- C-based nano-functional materials
- Nanotechnology for the sustainable energy and environments
- Engineer materials for mechanical enhancement – Lighter and stronger
- Innovative sensor technology – Let machines be more intelligent
- Soft-matter nanotechnology – To create new life forms with better healthcare, medicine, and food products, etc.

From basic research to entrepreneurship in nanotechnology

- The business of nanotechnology – Entrepreneurship, the challenge in translation from research to market, and commercialization
- Industrial and society issues – Benefits and risks for products with the implementation of nanotechnology in the global market, and the use of clusters to create value chains from industry to society
- The future of nanotechnology

Teaching and working methods

Lectures on science, technology, as well as social and business aspects.
A tour of materials research labs at Linköping University, for the growth and synthesis of nano-materials, and nano-scale-characterizations.
Project work in small groups, and a student Symposium “Nano near me” to present their investigated nano-topics.

Examination

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Requirement</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRA1</td>
<td>Active participation in the student conference</td>
<td>U,G</td>
<td>1 credits</td>
</tr>
<tr>
<td>TEN1</td>
<td>Written examination</td>
<td>U,3,4,5</td>
<td>6 credits</td>
</tr>
<tr>
<td>UPG1</td>
<td>Laboratory tour</td>
<td>U,G</td>
<td>0.5 credits</td>
</tr>
<tr>
<td>KTR1</td>
<td>Optional written tests</td>
<td>U,G</td>
<td>0 credits</td>
</tr>
</tbody>
</table>

Written quiz test during the course may give bonus points at the final exam.
Grades

ECTS

Subject area

Physics

Disciplinary domain

Science

Department

Department of Physics, Chemistry and Biology (IFM)

Director of Studies

Magnus Johansson

Examiner

Wei-Xin Ni

Education components

Seminar in plenum 6 h
Lecture 48 h
Study visit 12 h

Recommended self-study hours

-66 h