SK2775 Nanomaterials for Sustainable Energy and Environment 7.5 credits

Nanomaterial för hållbar energi och miljö

This is a translation of the Swedish, legally binding, course syllabus.

If the course is discontinued, students may request to be examined during the following two academic years

Establishment

Course syllabus for SK2775 valid from Autumn 2019

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Engineering Physics

Specific prerequisites

Bachelor's degree in Physics, Electrical Engineering, Materials science, Chemistry or equivalent, including courses in mathematics corresponding to at least 20 ECTS credits and courses in physics corresponding to at least 30 ECTS credits.

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

After the course, the student should be able to:

- Describe nanostructures for energy-related applications such as solar cells, catalysts, thermoelectrics, lithium ion batteries, supercapacitors, and hydrogen storage systems.
- Describe beneficial effects of sustainable nanotechnology on climate-change, improvement in our life quality, and promotion of natural resources
- Describe principles of catalysis (including photocatalysis) and the various common applications in environmental treatment
- Describe nanomaterials (including carbon nanotubes and nanostructured films/membranes) in membrane based water treatments as well as new nanotechnology based water treatment methods

Course contents

Nanomaterials have revolutionized our lives. They can be made by adding nanoscale components into existing materials or by designing them on their own. This course will present nanomaterials for a number of different applications related to for example energy and environmental mitigation techniques, to show the multidisciplinary possibilities of nanomaterials. This course intends to build around the multidisciplinary field to provide sufficient knowledge to the learner in order to understand the promising nanotechnology applications in the nexus between Energy, Environment and Sustainable Development. Main contents are:

- Environmental effects of energy extraction, conversion and use
- Sources of pollution from renewable and non-renewable energy technologies
- Systems- clean/green energy technologies
- Nanotechnology-Enabled Energy Harvesting for Self-Powered systems
- Nanomaterials in catalysis, photovoltaics, hydrogen exploitation, fuel cells, batteries, and thermoelectricity
- Insight into systems where nanotechnology are/can be used for sustainable development

Course literature

- Green nanotechnology: solutions for sustainability and energy in the built environment, Geoffrey B. Smith, Claes-Goran S. Granqvist, CRC Press (2010) (ISBN 9781420085327)
- Applying Nanotechnology for Environmental Sustainability, IGI Global, 2016 (978-1522505853), ed. Sung Hee Joo

- Fundamentals of Nanotechnology, (CRC Press of Taylor and Francis Group LLC), December 2008, 832pp, ISBN-13: 9781420048032, G. Louis Hornyak, John J. Moore, Harry F. Tibbals and Joydeep Dutta
- Nanotechnology: An Introduction, A volume in Micro and Nano Technologies, Jeremy Ramsden (ISBN: 978-0-08-096447-8)
- Nanotechnology and Global Sustainability, Eds. Donald Maclurcan, Natalia Radywyl, 2011, CRC Press (ISBN: 9781439855768)
- Green Photo-active Nanomaterials : Sustainable Energy and Environmental Remediation (RSC Green Chemistry Book Series), Eds. Nurxat Nuraje, Ramazan Asmatulu, Guido Mul, Royal Society of Chemistry, 2016, (ISBN; 978-1-78262-264-2)
- Nanomaterials for Sustainable Energy, Editors: Quan Li, (ISBN: 978-3-319-32021-2) Springer, 2016
- Nanomaterials for Sustainable Energy, Editor(s): Jingbo Louise Liu, Sajid Bashir, Volume 1213, 2015, American Chemical Society (ISBN: 9780841231160)
- Lecture notes and reference literature.

Examination

- ANN1 - Project and quiz, 2.5 credits, grading scale: P, F
- TEN1 - Written examination, 5.0 credits, grading scale: A, B, C, D, E, FX, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

- ANN1 - Project and Assignments, 2.5, grade scale: P, F
- TEN1 - Examination, 5.0, grade scale: A, B, C, D, E, FX, F

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.