

# **Molecular Physics**

Programme course

6 credits

Molekylär fysik

**TNE024** 

Valid from: 2017 Spring semester

**Determined by** Board of Studies for Electrical Engineering, Physics and Mathematics

Date determined 2017-01-25

# Main field of study

Applied Physics, Physics

#### **Course level**

Second cycle

#### Advancement level

A1X

#### Course offered for

• Electronics Design Engineering, M Sc in Engineering

#### Entry requirements

Note: Admission requirements for non-programme students usually also include admission requirements for the programme and threshold requirements for progression within the programme, or corresponding.

#### Prerequisites

Physical Modelling, Modern Physics

#### Intended learning outcomes

The course introduces the basics in molecular physics necessary to tackle more advanced courses in organic electronics. To succeed the course, the student is expected to be able to:

- use the knowledge from modern physics and mathematics
- describe the Schrödinger equation for atoms and molecules
- predict the structure and bonds in molecules and polymers
- explain the results from vibrational and optical spectroscopies used to characterize molecules and polymers
- explain various concepts and definitions (electron affinity, ionisation potential, electronegativity, Pauli principle, spin of particles and transition dipole moment)
- propose ways to control the optical properties of organic materials
- calculate the electronic structure of molecules and polymers in the Hückel approximation



#### Course content

Basics of quantum mechanics is introduced. Application of basic quantum mechanics to describe the formation of bonds in molecules and between molecules. The Schrödinger equation is used to extract the electronic structure of small conjugated molecules. Basics of chemical nomenclature is introduced. Bloch's theorem is applied to monomer units to predict the electronic structure of conjugated polymers. Spectroscopic techniques are introduced to show how to characterize various molecular properties: molecular vibrations, optical excitations and electronic structure. The principle of those spectroscopies is introduced using quantum mechanics.

# Teaching and working methods

Lectures, Lessons

# Examination

TEN1 Written examination

6 credits

U, 3, 4, 5

**Grades** Four-grade scale, LiU, U, 3, 4, 5

# Department

Institutionen för teknik och naturvetenskap

# Director of Studies or equivalent

Adriana Serban

Examiner Igor Zozoulenko

# Course website and other links

#### **Education components**

Preliminary scheduled hours: 40 h Recommended self-study hours: 120 h



# Course literature

#### Additional literature

Books Atkins, de Paula, *Physical Chemistry* 

#### Websites

Lecture notes



# **Common rules**

Regulations (apply to LiU in its entirety)

The university is a government agency whose operations are regulated by legislation and ordinances, which include the Higher Education Act and the Higher Education Ordinance. In addition to legislation and ordinances, operations are subject to several policy documents. The Linköping University rule book collects currently valid decisions of a regulatory nature taken by the university board, the vice-chancellor and faculty/department boards.

LiU's rule book for education at first-cycle and second-cycle levels is available at http://styrdokument.liu.se/Regelsamling/Innehall/Utbildning\_pa\_grund-\_och\_avancerad\_niva.

