# SI2550 Membranes and Soft Matter 7.5 credits

**Membran och mjuka material**

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

## Establishment

Course syllabus for SI2550 valid from Autumn 2007

## Grading scale

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

## Education cycle

Second cycle

## Main field of study

Physics

## Specific prerequisites

Recommended prerequisites: Thermodynamics and statistical mechanics corresponding to SI1161.

## Language of instruction

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

## Intended learning outcomes

The course aims at giving basic knowledge about atomic and field theoretical modeling of surfaces, interfaces and membranes with applications to biological membranes, material science and chemistry. After finished course the student should be able to:

- Describe and apply simple continuum models for membranes and interfaces.
- Formulate mean field models for binary mixtures using variational principles and solve these in simple cases.
- Determine ion concentration profiles and interactions between charged surfaces in solutions using electrostatic continuum models.
- Derive simple equations for the interactions between surfaces within the scope of a continuum theory for van der Waals interactions.
- Describe basic physical models for interactions in colloids, micro emulsions and solutions containing micelles and vesicles.
- Realize the limitations of simple continuum models.

## Course contents

Phase separation in binary mixtures, mean field theory for phase transitions, differential geometry for surfaces and hydromechanics. Surface tension. Thermal fluctuations of surfaces, capillary waves, wetting of surfaces, wetting profiles and contact angles. Continuum theory for van der Waals interactions. Electrostatics, Debye-Hueckel theory. Curvature and surface tension of thin membranes. Undulations and peristaltic fluctuations in membranes of finite thickness. Colloids, DLVO-theory and self aggregating surfaces Atomistic versus field theoretical modeling of membranes and surfaces.

## Course literature

S.A. Safran, Statistical Thermodynamics of Surfaces, Interfaces, and Membranes, Westview Press, 2002.

Other literature: D. Boal, Mechanics of the cell, Cambridge University Press, 2002.

## Examination

- INL1 - Assigment, 7.5 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.

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

## Other requirements for final grade

Solutions of given home exercises, which are to be discussed with the examiner (INL1; 7,5 university credits).

## 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.