



# FSI3420 Membranes and Soft Matter 7.5 credits

Membran och mjuka material

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 FSI3420 valid from Spring 2009

## Grading scale

## Education cycle

Third cycle

## Specific prerequisites

Thermodynamics and statistical mechanics.

## Language of instruction

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

## Intended learning outcomes

After completed course, the PhD 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

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.

## Other requirements for final grade

Solutions of given home exercises, which are to be discussed with the examiner.

## 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.