FSG3136 Statistical mechanics for engineers 5.0 credits

Statistisk mekanik för ingenjörer

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

Establishment

Course syllabus for FSG3136 valid from Autumn 2018

Grading scale

P, F

Education cycle

Third cycle

Specific prerequisites

The course assumes that the students have an undergraduate knowledge of Thermodynamics and Newtonian mechanics.

Language of instruction

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

Intended learning outcomes

After completing this course the student should manage to:

- describe the classical statistical mechanics framework and its connection with thermodynamics
- derive and apply the equipartition theorem
- discuss the ideal gas in the framework of classical statistical mechanics
- describe the Brownian motion of a colloid
- discuss application of statistical mechanics to micro and nanofluidics (e.g. electrohydrodynamics, transport in narrow pores, wetting)

Course contents

In this course, the statistical mechanics approach is introduced and examples of applications to micro- and nano-fluidics problems are discussed. The first part of the course is dedicated to the Hamilton formalism and the Louville equations. Then, the classical statistical mechanics is introduced (microcanonical and canonical ensemble). Ideal gas thermodynamics is derived using the canonical ensemble. The last part of the course is dedicated to example of application of statistical mechanics to fluid dynamics problem such as, wetting, Brownian motion of a colloid and particle transport in nanofluidic devices. Finally, we will provide an introduction to Molecular Dynamics simulations for the different applications mentioned.

Course literature

--Huang, Kerson. "Statistical Mechanics, 2nd." Edition (New York: John Wiley & Sons) (1987).

Cap 1, 6, 7.1,7.2

--San Miguel, Maxi, and Raul Toral. "Stochastic effects in physical systems." Instabilities and nonequilibrium structures VI5 (2000): 35-127. Cap 1, 2.1

--Your own lecture notes and other distributed course material

Examination

- PRO1 - Project, 2.0 credits, grading scale: P, F
- TEN1 - Examination, 3.0 credits, grading scale: P, 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

Project work with final presentation in groups of 2. Oral exam.

PRO1 - Project, 2. Grade scale: P, F

TEN1 - Examination, 3, grade scale: P, 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.