UNIVERSITY OF GOTHENBURG

DEPARTMENT OF PHYSICS

FYM305 Statistical physics, 7.5 credits

Statistisk fysik, 7,5 högskolepoäng

Second Cycle

Confirmation

This course syllabus was confirmed by Department of Physics on 2019-03-11 and was last revised on 2023-05-08 to be valid from 2024-01-15, spring semester of 2024.

Field of education: Science 100%
Department: Department of Physics

Position in the educational system

The course is elective within the master program in physics.

The course can be part of the following programmes: 1) Complex Adaptive Systems, Master's Programme (N2CAS) and 2) Physics, Master's Programme (N2PHY)

Main field of studies	*Specialization*
Physics	A1N, Second cycle, has only first-cycle course/s as entry requirements

Entry requirements

A Bachelor's degree in physics or equivalent, including 30 credits mathematics (including linear algebra and analysis) as well as thermodynamics and quantum mechanics.

Applicants must prove their knowledge of English: English 6/English B from Swedish Upper Secondary School or the equivalent level of an internationally recognized test, for example TOEFL, IELTS.

Learning outcomes

Statistical physics comprises several general concepts and very powerful tools to study the properties of many-degree-of-freedom systems as well as the influence of the external

world on systems. The latter leads to stochastic fluctuations, i.e., different forms of noise. The methods of statistical physics have a wide range of applications such as in astrophysics, biophysics, materials science, quantum information, economy, and even social sciences. The purpose of this course is to introduce the students to some of the most commonly used concepts and tools of statistical physics and demonstrate how they find their use in a very broad range of application areas.

On successful completion of the course the student will be able to:

Be able to explain and demonstrate a qualitative understanding of the elements listed in the Content section below. The student should also possess the ability to apply these concepts and methods in a quantitative way to at least one subdiscipline of physics.

Course content

- Brownian motion and phase space dynamics (single-particle vs ensemble description)
- Density matrix approach (quantum statistical physics)
- Phase transitions and interacting systems
- Entropy irreversibility and information
- Master equation and detailed balance
- Linear response, susceptibilities, noise, fluctuation-dissipation theorem

Form of teaching

The course will have two lectures and one problem-solving session per week during the first seven weeks of the course. During the eighth and final week, there will be compulsory student-led seminars, where each student gives an oral presentation.

Language of instruction: English

Assessment

Examination and grading will be based on the solutions to the hand-in problems, participation in the final seminar and performance on the final oral examination.

If a student, who has failed the same examined element on two occasions, wishes to change examiner before the next examination session, such a request is to be submitted to the department in writing and granted unless there are special reasons to the contrary (Chapter 6, Section 22 of Higher Education Ordinance).

In the event that a course has ceased or undergone major changes, students are to be guaranteed at least three examination sessions (including the ordinary examination session) over a period of at least one year, though at most two years after the course has ceased/been changed. The same applies to work experience and VFU, although this is

restricted to just one additional examination session.

Grades

The grading scale comprises: Pass with Distinction (VG), Pass (G) and Fail (U).

Course evaluation

The results of and possible changes to the course will be shared with students who participated in the evaluation and students who are starting the course.