FYM121   Computational physics, 7.5 credits

Beräkningsfysik, 7,5 högskolepoäng
Second Cycle

Confirmation

This course syllabus was confirmed by Department of Physics on 2024-01-31 to be valid from 2024-09-02, autumn semester of 2024.

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

Position in the educational system

elective course

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 course in quantum mechanics and course in programming.

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

The aim of the course is to refine computational skills by providing direct experience in using a computer to solve problems in physics. Numerical techniques are introduced and applied in a broad spectrum of various physical problems. The course is designed to

develop an understanding of modeling physical systems using different numerical techniques.

Learning outcomes (after completion of the course the student should be able to)

use C to solve numerical problems.
explain and numerically apply the basic idea behind the molecular dynamics simulation method.
explain how random numbers can be used to treat static and dynamic phenomena and numerically apply the methodology.
explain and numerically apply the Metropolis Monte Carlo method.
integrate knowledge in modeling physical systems with various numerical techniques.

write well-structured technical reports where computational results are presented and explained.
communicate results and conclusions in a clear way.

Course content
the programming language C
ordinary differential equations, molecular dynamics simulation
random numbers, random processes, Brownian dynamics
discrete and fast Fourier transforms, power spectrum analysis
Monte Carlo integration and the Metropolis algorithm
Variational and diffusion Monte Carlo

Form of teaching
The different numerical techniques and the physical problems are presented in a series of lectures. The most important part in the course is the students own activity in applying the methods and solving a set of exercises and homework assignments. Scheduled computer laboratory sessions are provided, with instructors available for consultation. The programming language C is being used in the course.

Language of instruction: English

Assessment
The examination is based on computer exercises and project reports.

If a student who has twice received a failing grade for the same examination component wishes to change examiner ahead of the next examination session, such a request should be made to the department in writing and should be approved by the department unless there are special reasons to the contrary (Chapter 6 Section 22 of the Higher Education Ordinance). If a student has received a recommendation from the University of

Gothenburg for study support for students with disabilities, the examiner may, where it is compatible with the learning outcomes of the course and provided that no unreasonable resources are required, decide to allow the student to sit an adjusted exam or alternative form of assessment. 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, but no more than two years after the course has ceased/been changed. The same applies to internships and professional placements (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.