UNIVERSITY OF GOTHENBURG

DEPARTMENT OF PHYSICS

FYM110 Computational biology, 7.5 credits

Beräkningsbiologi, 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

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 with Specialization in Complex Adaptive Systems	A1N, Second cycle, has only first-cycle course/s as entry requirements
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 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 introduce students to the mathematical modeling of biological systems. The emphasis is on macroscopic phenomena such as population growth, morphogenesis and spreading of infectious diseases. Also microscopic phenomena are introduced, such as biochemical reactions, population genetics, and

molecular evolution. A major topic is the role played by chance in the dynamics of biological systems, giving rise to stochastic fluctuations that must be described with statistical methods. The goal is to introduce mathematicians, physicists, and engineers to current important questions in Biology that require quantitative methods to solve.

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

explain what can be expected of mathematical models of biological systems, and what cannot be expected
decide whether deterministic or stochastic models are required in a given context
simulate deterministic and stochastic models for biological systems on a computer, and understand and describe the implications of the results clear and logical fashion
understand the purpose and predictive power of models of evolution
reflect ethical aspects especially regarding population genetics

Course content

Continuous and discrete population dynamics. Competition between species. Stochastic models for population growth.

Biochemical reactions. Reaction-diffusion systems. Morphogenesis. Traveling waves. Deterministic vs. stochastic models for chemical reactions.
Models for disease spreading- Deterministic and stochastic models.

Population genetics.
Synchronisation of oscillators in biological systems.

Form of teaching

Lectures, set of homework problems, examples classes, and written exam.

Language of instruction: English

Assessment

The final grade is based on three sets of homework assignments (50%) and a written examination (50%).

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.