UNIVERSITY OF GOTHENBURG

DEPARTMENT OF PHYSICS

FYM315 Biological and biotechnical physics, 7.5 credits

Biologisk och bioteknisk fysik, 7,5 högskolepoäng

Second Cycle

Confirmation

This course syllabus was confirmed by Department of Physics on 2019-11-04 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 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 optics, thermodynamics and statistical physics.

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 course is aimed at providing the basic theoretical tools and an increased understanding of central concepts in biological and biotechnical physics. It will also provide an enhanced capability of planning, conducting, analyzing and presenting experimental with focus on medical diagnostics and drug development.

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

Understand and use key vocabulary and physical concepts of relevance for biological systems, and be able to describe the basic physical aspects of biological molecules, such as for example DNA, RNA, proteins, enzymes, cell membranes and live cells. Gain new insights about the structural complexity of live cells, exemplified using e.g. photosynthesis, the respiration chain and the function of our senses. Gain knowledge on how to plan and perform experiments in the subject, thereby gaining qualitative insight in some of the main concept of the course, with focus on biosensing and optical imaging.

Course content

The theory part focuses on the following aspects: i) The molecules that are the functional building blocks of living organisms, ii) Physical models to describe life processes iii) Intermolecular interactions in chemical (non)equilibrium in the living cell, iv) Random walks and dynamical molecular machines, v) Biological membranes and transport into and out of cells, vi) Biological electricity, photosynthesis and the function of our senses.
An important aspect of the course is to utilize the tools and knowledge you have from before in thermodynamics, statistical physics, solid state physics and soft matter physics (or chemistry, biochemistry, physical chemistry if your background is not physics). The experimental part of the course consists of i) one introductory experiment in which you get used to handling buffers and biomolecules in experiments and ii) a larger project focusing on some of the fundamental concepts in the course, such the physical base for the intermolecular interactions that are utilized in e.g. medical diagnostics and how bioanalytical tools and different optical imaging systems are used in biotechnology and diagnostics.
An important aim with the experimental part is that you will get training of working in a wet-chemistry biological laboratory with biological molecules and solvents. The main experimental techniques that will be used are fluorescence microscopy, optical (UV-VIS), fluorescence spectroscopy and surface-sensitive tools. You will gain experience in planning and performing a biophysics experiment from the beginning to the end and to analyze and present the results in a written report and in an oral seminar.

Form of teaching

The course consists of around 12 lectures, focusing on theoretical models applicable to Biological Physics, and how the experimental methods used in the laboratory exercises and projects relate to the theory part, including additional applications of biological physics. It also included an experimental part consisting of both training experiments and a more challenging experimental project to be run at three occasions in groups of 3-4 students during the entire course

Language of instruction: English

Assessment

Two to three home problems and two oral exams (one in group and one individual) covering the theory part. Written and oral presentation of the experimental project at the end of the course. The theoretical and experimental parts will have an equal weight in the final grade.

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.