Faculty of Science

FYTN05, Theoretical Physics: Theoretical Biophysics, 7.5 credits

Teoretisk fysik: Teoretisk biofysik, 7,5 högskolepoäng

Second Cycle / Avancerad nivå

Details of approval

The syllabus was approved by Study programmes board, Faculty of Science on 2007-03-01 (N2007267). The syllabus comes into effect 2007-07-01 and is valid from the autumn semester 2007.

General information

The course is for second-cycle studies for a Degree of Master of Science (120 credits) with a specialisation in physics.

Language of instruction: Swedish and English
If needed, the course is given in English in its entirety.

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

Learning outcomes

The purpose of the course is to give the student knowledge of physics problems encountered in biology.

The aims of the course are that, upon completion of the course, the student should have acquired the following knowledge and skills:

- Cell composition and contents: The student can describe the composition of the cell and its contents of molecules and molecular mechanisms.
- Fundamentals of statistics and statistical molecular kinematics: The student can describe and use statistical distributions, in particular the Gaussian distribution, mean value and standard deviation. The student can describe and use the Boltzmann distribution in various applications.

- Brownian motion, random walks and diffusion: The student can describe random walks and derive their characteristic behaviour. The student can demonstrate how random walks gives rise to the diffusion equation and how diffusion is related to viscosity. The student can describe various biological applications of diffusion.
- Viscous media: The student can explain the Reynolds number and Stoke's law and describe various biological applications of viscous flow.
- Entropy, free energy and two-state systems: The student can explain the concepts of statistical weight and entropy and their relation. The student can explain the concept of free energy and treat two-state systems.
- Entropic forces: The student can explain the concepts of osmotic pressure, hydrogen bonds, hydrophilic and hydrophobic groups.
- Chemical forces: The student can explain the concept of chemical potential and describe chemical equilibrium. Student can describe the formation of micelles and is familiar with various applications.
- Macromolecules: The student can describe basic structure formation of macromolecules such as proteins and DNA.
- Molecular mechanisms and machines: The student can describe nerve signals or a molecular machine of his or her choice, for example motor proteins or ion channels.

Examples of problems that the student should be able to solve upon completion of the course:

- Applications of diffusion (Fick's law and the diffusion equation).
- Viscous flow in vascular networks (Hagen-Poiseuille's law).
- Extension vs. force for chains of given length and persistence length (worm-like chains).

Course content

The course consists of the elements described above for a total of 7.5 credits.

Course design

The teaching consists of lectures and exercises.

Assessment

The examination consists of written hand-in assignments, an oral seminar assignment and an oral test. Students who do not pass the regular exam are offered a re-exam shortly after the regular exam.

Grades

Grading scale includes the grades: Fail, Pass, Pass with distinction
To pass the entire course, a passed oral test as well as passed written hand-in assignments and passed seminar assignment are required.
The final grade is determined by combining the results in the different parts of the examination.

Entry requirements

The prerequisites required for admission to the course are: English B and general entry requirements as well as knowledge equivalent to 90 credits in physics and 30 credits in mathematics.