LUNDS UNIVERSITET
Lunds Tekniska Högskola

Course syllabus

Molekylära drivkrafter 2: Växelverkan och dynamik
Molecular Driving Forces 2: Interactions and Dynamics

KFKF01, 7,5 credits, G2 (First Cycle)

Valid for: 2023/24
Faculty: Faculty of Engineering, LTH
Decided by: PLED B/K
Date of Decision: 2023-04-18

General Information

Main field: Technology.
Compulsory for: B2, K2
Elective for: N4-nbm, N4-m
Language of instruction: The course will be given in Swedish

Aim

The aim of the course is to provide the students with knowledge about the connection between the intermolecular interactions in a macroscopic system and its static and dynamic properties. These insights provide the fundamental basis for further studies in chemical analysis and separation, reaction engineering, pharmaceutical chemistry, molecular biotechnology and nano science.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

1. be able to demonstrate knowlede on how molecular properties are responsible for the intermolecular interaction and how they control macroscopic behaviour, such as phase separation, non-ideality and solvent properties.
2. be able to demonstrate knowledge on the molecular background to dynamics in chemical systems, for example diffusion and reaction kintetics.

Competences and skills
For a passing grade the student must

1. be able to analyze a problem and be able to perform relevant calculations using the models and equations presented in the course.
2. be able to use a pocket calculator or computer to solve common numerical problems.
3. be able to peform chemical laboration in a safe and accurate manner, including use of laboratory equipment.
4. be able to write simple, but complete, reports of laboratory experiments according to given instructions, including correct presentation of data and error estimates.

Judgement and approach
For a passing grade the student must

1. be able to discuss everyday phenomena, such as phase separation between oil and water, on the basis of the course content.
2. be able to discuss biologically relevant problems on the basis of the fundamental models that are presented in the course.
3. be able to judge the validity of the models that are presented in the course.

Contents

The course shows how intermolecular interaction gives rise to structure on a microscopic and mesoscopic level and how it gives a qualitative explanation of and an ability to predict macroscopic properties. This presents a molecular explanation to much of phenomenological thermodynamics and macroscopic transport processes. It also gives the tools needed to predict how manipulations on the molecular level affect the microscopic properties of a (bio)material. The course consists of classical electrostatics and intermolecular interactions, and statistical thermodynamics with applications to adsorption, liquids and solutions of electrolytes.

The properties of bioplolymers, such as proteins and DNA-molecules, are treated specifically.
Two full lectures are used to cover the properties of liquid water and its unique importance for the solvation of and the interactions between both large and small (bio) molecules.

The course also treats molecular motion in liquids (diffusion) and thereby presents the molecular basis for macroscopic transport processes and reaction kinetics of enzymes.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)
Assessment: Written examination, laboratory exercisers and a home assignment. The final grade is based on the written examination. Bonus points to the written exam may be awarded for performed tasks. The bonus points are then valid only for the ordinary exam and the following two re-exams. Students who are awarded bonus points for performed tasks cannot be awarded bonus points for the same tasks once again when re-registered.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Parts

Code: 0116. **Name:** Written Examination.
Credits: 6,5. **Grading scale:** TH. **Assessment:** Written examination.

Code: 0216. **Name:** Laboratory Exercises and Home Assignment.
Credits: 1. **Grading scale:** UG. **Assessment:** For passing grade, every task is performed and presented according to the instructions, which may mean either as a written report or orally, in Swedish or English. For passing grade, the written reports should be simple but correct and to the point, have a proper structure and contain a relevant discussion of the results. **Contents:** The wet laboratory experiments, one demonstrative task in computer simulation and one home assignment.

Admission

Admission requirements:

- FMAA05 Calculus in One Variable or FMAB65 Calculus in One Variable B1 or FMAB70 Calculus in One Variable B2

Assumed prior knowledge: FMAB30 Calculus in Several Variables, FMAA20 Linear Algebra with Introduction to Computer Tools, KFKA05 Molecular Driving Forces 1: Thermodynamics
The number of participants is limited to: No
The course overlaps following course/s: KFK080, KFK090

Reading list

- Dill, K and Bromberg, S: Molecular Driving Forces, Statistical Thermodynamics in Chemistry, Physics, Biology and Nanoscience. 2nd edition. Garland Science, 2010, ISBN: 9780815344308.

Contact and other information

Course coordinator: Kristofer Modig, kristofer.modig@bpc.lu.se
Course coordinator: Pär Söderhjelm, par.soderhjelm@bpc.lu.se
Course homepage: https://www.cmps.lu.se/education/
Further information: Some teaching might be held in English. In the transition to new prerequisites, the course coordinator will look at completed parts of the course FMAA05 Calculus in One Variable. However, this check is done manually and may take slightly longer than the automatic check.