LUNDS UNIVERSITET
Lunds Tekniska Högskola

Course syllabus

Masstransport i naturliga och tekniska system
Mass Transfer Processes in Environmental Engineering

KETF40, 15 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: W3
Language of instruction: The course will be given in English

Aim

The course aims at giving the student a deep and internalized understanding of how mass flow can be characterised, systemised and quantified as well as making them able to do mass balance calculations for numerous situations and systems. The course also aims at connecting knowledge and skills, acquired by the student in earlier courses in the engineering education, in such a way that it strengthens the student's capacity to solve engineering problems. Group tasks and seminars aims at developing the students' communicative skills and ability to cooperate on a professional level. The study visits illustrate how the theoretical content of the course is used by civil engineers in their profession and thus aims at inspiring the student and to facilitate the student's choice of specialisation.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- be able to independently calculate, by hand as well as with mathematical computer software, how the physical characteristics of a substance influence the macroscopic

transport of mass and heat in systems with a simple geometry,
- be able to theoretically analyse, model and perform process calculations for systems consisting of a limited number of units and by means of degrees of freedom analysis, suggest and thereafter use a suitable problem solving strategy,
- be able to theoretically analyse, model, compare and solve reactor calculations based on ideal and non-ideal mixing models and different kinetic rate expression, by hand and by numeric simulations,
- solve mass balance problems for simple binary systems with phase equilibrium, and
- define and solve energy balance problems for simple systems without reaction.

Competences and skills
For a passing grade the student must

- orally, in writing and visually in English demonstrate an ability to clearly discribe and discuss mass balance, mass transfer and heat transfer problems in natural and engineered systems,
- demonstrate an ability to critically evaluate applicability and limitations of theoretical models used in the course, and
- demonstrate ability to work in teams of students.

Judgement and approach
For a passing grade the student must

- demonstrate ability to reflect over her/his learning process within the program and identify needs for additional knowledge and skills.

Contents

Methods for process and reactor calculations for analysis and quantification of mass flow in technical as well as natural systems. The interplay between macroscopic transport and chemical reactions, mixing models and residence time distributions. Applications to transport in biofilms and ground water as well as transformation of substances in surface waters.

The fundamentals of molecular (i.e. diffusive) and convective transport. Models for phase equilibrium and principles for selection and design of a number of separation processes. Design of equipment for heat transfer and examples of how separation processes can be applied in an environmentally friendly fashion.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)
Assessment: Written examination, a voluntary written test, assignments, laboratory, study visits and active participation in seminars. Final grade is based upon the written exam and complementary points on compulsory assignments. For grade 4 and 5 respectively the student must reach a minimum level of complementary points, the exact level of which is announced each year at the beginning of the course. All examination, with the exception of some seminars and study visits, are carried out in English. The forms of examination of

the compulsory assignments may change between years and are defined prior to each assignment.

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: 0117. **Name:** Examination.
Credits: 7. **Grading scale:** UG. **Assessment:** Written examination and a voluntary written test. **Contents:** Process and reactor calculations, fundamental mass transfer and separation processes.
Code: 0217. **Name:** Assignment (Period 2).
Credits: 2. **Grading scale:** UG. **Assessment:** Active participation in laboratory, assignments and seminars. **Contents:** Process and reactor calculations, fundamental mass transfer and separation processes
Code: 0317. **Name:** Assignments (Period 3).
Credits: 5. **Grading scale:** UG. **Assessment:** Assignments and seminars. **Contents:** Application of fundamental theory on industrial processes and transport and transformation of substances in the environment
Code: 0417. **Name:** Study Visit.
Credits: 1. **Grading scale:** UG. **Assessment:** Study visits.

Admission

Assumed prior knowledge: FMAA05, FMAA20, FMAB30, VVRF10, KFKA01.
The number of participants is limited to: No
The course overlaps following course/s: KTE170

Reading list

- Warfvinge, P: Process Calculations and Reactor Calculations for Environmental Engineering. 2021.
- Alveteg, M: Introduction to transport phenomena and separation processes. MediaTryck, 2021. Version history published on course web for those who considers buying earlier edition/a used copy.
- M Alveteg (editor): Handbook, Physical Properties, Correlations and Equations in Chemical Engineering. MediaTryck, 2021. Updated yearly by the Dept of Chemical Engineering, version history available.
- M Alveteg: Diagrams & support for note taking. MediaTryck, 2022. Made available as pdf but is usually also printed by MediaTryck. Printouts of diagrams is required for graphical solutions of exercises.

Contact and other information

Course coordinator: Universitetslektor Mattias Alveteg, mattias.alveteg@chemeng.lth.se
Course homepage: https://www.ple.lth.se/en/
Further information: During study period 3, each week includes compulsory classes such as study visits and seminars.