LUNDS UNIVERSITET
Lunds Tekniska Högskola

Course syllabus

Reaktionsteknik
Reaction Engineering

KETF25, 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: B3, K3
Language of instruction: The course will be given in Swedish

Aim

The reactor is the site of chemical transformations in industrial processes. The design and sizing of the reactor is determined by the interaction between reaction rates of the various possible reactions, diffusion of reactants and products, released reaction heat and the possibilities to cool the reactor and achieve the necessary mixing of reactant streams. The aim of the course is to provide a fundamental understanding of the interaction between the physical processes and chemical reactions in a reactor, and the ability to formulate a mathematical description of these for the purpose of analysis and design. The course will also provide knowledge about the main types of reactors for homogeneous and heterogeneous reactions, examplified by important examples from chemical and biochemical industry.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- be able to explain the basic assumptions for common expressions of kinetics for both homogeneous and heterogeneous reactions
- be able to describe the ideal reactor types; i.e. the ideal stirred tank reactor and the plug-flow reactor.
- be able to make a well-founded choice of reactor design, for a systems with a single

reaction as well as systems with a few parallell or consecutive reactions
- be able to in qualitative terms explain the effect of mass transport on the reaction rate in heterogeneous (catalytic) processes.

Competences and skills
For a passing grade the student must

- be able to set up and solve mathematical models for ideal reactors under isothermal conditions for a single reaction and multiple reactions
- be able to formulate the energy balance of a reacting system with and without cooling, and calculate the cooling and heating needs
- be able to use computational tools to simulate the chemical reactors and use kinetic expressions.
- be able to make simple estimations of the effect of mass transfer in catalytic processes

Contents

Fundamental reaction kinetics: Rate expressions, rate constants and temperature dependence, relation between kinetics and equilibrium, analysis of batch reactors.
Ideal reactors: The stirred tank reactor and the plug flow reactor, reactions with mole changes, multiple reactions, reactors in parallell and series.
Non-isothermal reactors: Reactor stability in the CSTR, adiabatic plug flow reactors, adiabatic equilibrium reactions.
Heterogeneous systems: Qualitative and simplified quantitative analysis of the effects of mass transport, catalysts.
Non-ideal reactors: Residence time distributions, characterization of flow patterns.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)
Assessment: Written examination and computer exercises. The grade is based on the written examination.

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: 0113. **Name:** Reaction Engineering.
Credits: 7. **Grading scale:** TH. **Assessment:** Written examination
Code: 0213. **Name:** Computer Excercises.
Credits: 0,5. **Grading scale:** UG. **Assessment:** Computer exercises

Admission

Admission requirements:

- KETF01 Transport Phenomena, Basic Course or KFKA05 Molecular Driving Forces 1: Thermodynamics

Assumed prior knowledge: KETA10 or KLGA01, FMAA015.
The number of participants is limited to: No
The course overlaps following course/s: KET045, KTE023

Reading list

- George W. Roberts: Chemical Reactions and Chemical Reactors. Wiley, 2009, ISBN: 978-0471-742203.

Contact and other information

Course coordinator: Sara Blomberg, sara.blomberg@chemeng.lth.se
Course homepage: https://www.ple.lth.se/en/