KE1020 Reaction and Separation Engineering 10.5 credits

Reaktions- och separationsteknik

This is a translation of the Swedish, legally binding, course syllabus.

Establishment

Course syllabus for KE1020 valid from Autumn 2012

Grading scale

A, B, C, D, E, FX, F

Education cycle

First cycle

Main field of study

Chemistry and Chemical Engineering, Technology

Specific prerequisites

Completed upper secondary education including documented proficiency in English corresponding to English A. For students who received/will receive their final school grades after 31 December 2009, there is an additional entry requirement for mathematics as follows: documented proficiency in mathematics corresponding to Mathematics A.

And the specific requirements of mathematics, physics and chemistry corresponding to Mathematics E, Physics B and Chemistry A.

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

After passing the course the student should be able to:

- analyse the use of energy and materials in a production unit based on chemical engineering, environmental, societal and economical criteria
- reflect in a structured way over his own professional role as an engineer and his professional responsibility in conjunction with sustainable development
- distinguish between facts and values and show that considerations based on these can yield different results depending on fundamental values
- size simple components in a chemical process system
- explain the concept of an ideal stage and utilize this in sizing separation equipment in continuous systems
- suggest a suitable separation method in a two-component system based on the physical properties of the compounds
- explain how the driving force for mass transport influences the sizing of a separation process with mass transfer
- suggest design and operational parameters for ideal reactors to minimize waste based on ideal reactor models and the selectivity concept
- explain the importance of volume change in gas-phase reactions in ideal reactors and calculate the actual residence time
- analyse how kinetics, external mass transfer and pore diffusion influence the operation of catalytic reactors
- briefly describe the most common battery and fuel cell systems
- analyse electrochemical systems by applying fundamental electrochemical concepts
- show the ability to efficiently work in groups, and plan and carry out projects within a given time fram
- show the ability to present and discuss ideas and results in both oral and written form

Course contents

Fundamental kinetic and reaction engineering concepts. Kinetics for electrode reactions. Multiple reactions and systems with volume change. Ideal reactor models and models for catalytic reactors. Residence times and space velocities. Heterogeneous catalysis, enzymatic reactions and bioreactors. Fundamentals in separation engineering directed towards heat and mass transfer between two phases. Phase equilibria and the ideal stage principle. Distillation, absorption and extraction. Evaporation and drying. Orientation about crystallisation and membrane separation processes. Orientation about equipment for separation techniques and for production of chemicals. Equipment for heat exchange. Electrochemical power sources. Choice and operation of ideal reactors.

Course literature

- Fogler, H.S., Elements of Chemical Reaction engineering. 4rd ed., Pearson Education, Upper Saddle River, N.J., USA, 2005.
- Coulson, J.M. and Richardson, J.F., Chemical Engineering, Vol. 1,6th ed., 2000 (köpt i TEO) och Vol. 2, 5th ed., 2002
- Behm, M., Lagergren, C. Och Lindbergh, G., Elektrokemi för bränsleceller och batterier, Inst för kemiteknik, 2001.
- Övningsuppgifter i reaktions- och separationsteknik, Inst för kemiteknik, 2003.
- Diagramsamling, reaktions- och separationsteknik, Inst för kemiteknik, 2004.

Examination

- PRO1 - Project, 3.0 credits, grading scale: P, F
- TEN1 - Examination, 4.5 credits, grading scale: A, B, C, D, E, FX, F
- LAB1 - Laboratory Course, 3.0 credits, grading scale: P, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

If the course is discontinued, students may request to be examined during the following two academic years.

The "Laboratory Course" includes homework assignments, labs and computer labs.

Other requirements for final grade

Examination (TEN1; 4,5 credits)
Laboratory Course (LAB1; 3 credits)
Project (PRO1; 3 credits)

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.