KE2070 Transport Phenomena, Advanced Course 7.5 credits

Transportprocesser, fortsättningskurs

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

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

Establishment

Course syllabus for KE2070 valid from Autumn 2018

Grading scale

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

Education cycle

Second cycle

Main field of study

Chemical Science and Engineering,Chemistry and Chemical Engineering

Specific prerequisites

Admission requirements for programme students at KTH:
At least 150 credits from grades 1, 2 and 3 of which at least 110 credits from years 1 and 2, and bachelor's work must be completed, within a programme that includes:
75 university credits (hp) in chemistry or chemical engineering, 20 university credits (hp) in mathematics and 6 university credits (hp) in computer science or corresponding.

Admission requirements for independent students:
75 university credits (hp) in chemistry or chemical engineering, 20 university credits (hp) in mathematics and 6 university credits (hp) in computer science or corresponding. Documented proficiency in English corresponding to English B.

Language of instruction

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

Intended learning outcomes

Students will obtain deeper knowledge about momentum, heat and mass transfer, which constitutes a foundation for applied courses in chemical science and chemical engineering education.

After passing the course the students will be able to:

- explain the mechanisms for momentum transfer for flow around solid bodies and how these mechanisms influence heat and mass transfer.
- specify and explain the fundamental transport equations that describe non steady-state heat and mass transfer, i.e conduction and diffusion equations (with or without production term)
- develop modelling thinking by relating a problem involving non steady-state heat and mass transfer to the fundamental transport equations and specify initial and boundary conditions
- introduce suitable simplifications and asses the effects of the simplifications on model applicability
- describe qualitatively a non steady-state physical process related to a given conduction or diffusion equation with corresponding initial and boundary conditions
- with deeper knowledge in mathematics and numerical methods, solve the equations analytically or numerically
- identify and solve problems about flow along a flat surface and simple cases of two-phase flow
- identify and solve simple cases of non steady-state heat transfer by conduction and convection as well as heat transfer in finned tubes
- identify and solve simple cases of non steady-state mass transfer including diffusion and bulk flow as well as simple cases of simultaneous heat and mass transfer
- identify and solve simple cases multicomponent diffusion and mass transfer in the presence of other driving forces, for instance pressure and electrical potential gradients.

Course contents

The course covers:

- Interface momentum transfer.

- Boundary layer theory.
- Flow around particles, droplets and bubbles.
- Two-phase flow.
- Unsteady heat transfer.
- Heat transfer from fluids to bodies.
- Unsteady diffusion.
- Interface mass transfer.
- Analogies between momentum, heat and mass transfer.
- Boundary layer theory applied to heat and mass transfer
- Multicomponent diffusion and influence of other driving forces.
- Simultaneous heat and mass transfer

Course literature

Coulson J.M. and Richardson J.F., Chemical Engineering vol. 1, 6:te upplagan, Butterworth Heinemann, 2000, och vol. 2, 5:te upplagan, Butterworth Heinemann, 2002.
J. Welty, G.L: Rorrer, D.G. Foster: Fundamentals of Momentum, Heat and Mass Transfer, Wiley (2014)
R. B. Bird, W. E. Stewart, E. N. Lightfoot, "Transport Phenomena, 2nd Ed." Wiley 2007

Examination

- SEM1 - Assignments, 3.8 credits, grading scale: P, F
- TEN1 - Written exam, 3.7 credits, grading scale: A, B, C, D, E, FX, 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.

Other requirements for final grade

Assignment (SEM1; 3,8 credits)
Examinations during the course or a final written examination (TEN1; 3,7 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.