MH1018 Transport Phenomena 6.0 credits

Transportfenomen

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 MH1018 valid from Autumn 2009

Grading scale

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

Education cycle

First cycle

Main field of study

Materials Science,Technology

Specific prerequisites

Proficiency corresponding to
MH1010 Thermodynamics of Materials, 9 credits, or similar

Language of instruction

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

Intended learning outcomes

After the course the student should be able to:

- Newton's viscosity law
  -Calculate rates and forces
- Bernoulli's principle
  -Calculate of pressure differences, flow rates and potential energy
- Fick's first law
  -Calculate flows, gradients and diffusion rate
- Fick's second law
  -Calculate time, concentration and distance
- Conduction
  -Calculate temperature gradients and flow
- Convection
  -Calculate the heat transfer between two phases
- Radiation
  -Calculate the radiated energy and radiant exchange between black and gray surfaces
- Transport Parameters
  -Estimate parameters based on the material structure, diffusion coefficient, thermal diffusivity and viscosity

Course contents

- Fluid floww
  -Description of fluids flow. In principle, flow is treated based on how momentum is transported, based on Newton's viskosity law. For non Newtonian fluids other laws, which are of importance, when flow involving larger molecules are treated. Within this part even Bernoulli equation is treated, which allows relatively simple calculations to complex engineering systems.
- Material diffusion
  -Diffusion based on Fick's first law, which says that a material flow arises when a gradient in the chemical potential exists. Students are trained in the process flow and to perform simple calculations in cases where the concentration varies with time. Applications within thermal treatment of metallic materials and solubility and transport of low molecular compounds of polymers and cellulose base materials.
- Heat
  -Flow of heat dealing with conduction, convection and radiation. All three are vital within a wide range of engineering-related applications. Fouriers law and Newton's law of cooling allows for simple calculations on heat transfer and heat conduction. The radiation gives an insight into electromagnetic radiation.
- Transport Parameters
  -Since most material are treated, the parameters that control the transport are treated separately.These include viscosity, diffusion constant and thermal diffusivity. Mechanisms

for all of these differ significantly between the metal/ceramic materials and polymers/cellulose-based materials.

- Principles of transport deals with the following materials
  -Metals
  -Ceramics
  -Polymers
  -Cellulos-based materials
  -Biomaterials

Disposition

Lectures 24 h
Exercises 24 h

Course literature

Transport and Chemical Rate Phenomena. Nickolas J. Themelis. OPA (Overseas Publishers Association. Amsterdam, The Netherlands. 1995. ISBN: 2-88449-127-9.
Transport Properties of Polymers. Hedenqvist, Mikael, KTH, Department of Fibre and Polymer Technology, Stockholm, Sweden (2005).
Övningshäfte

Examination

- TEN1 - Examination, 2.0 credits, grading scale: A, B, C, D, E, FX, F
- TEN2 - Examination, 3.0 credits, grading scale: A, B, C, D, E, FX, F
- ÖVN1 - Assignments, 1.0 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.

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.