F3C5701 Transport Phenomena 9.0 credits

Teknisk strömningslära

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 F3C5701 valid from Autumn 2016

Grading scale

undefined

Education cycle

Third cycle

Specific prerequisites

Have taken Transport phenomena and engineering thermodynamics (KE1030)

or equivalent,

- Introductory course(s) in transport phenomena including mass, momentum, and/or heat.

- Mathematical ability to solve analytically simple, first and second ordinary differential equations, knowledge of elementary functions and vector analysis.

Language of instruction

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

Intended learning outcomes

The main aim is to give a balanced overview of the field of transport phenomena, discussing the fundamental theories of the subject, and illustrating how to use them to solve transport problems.

Upon the completion of the course, you will be able to:

- Identify and describe mechanisms of transport phenomena, present in given isothermal and non-isothermal, laminar and turbulent flow systems.

- Establish and simplify appropriate conservation statements (the general equations of change and macroscopic balances) for steady and unsteady mass, momentum and heat transfer processes at microscopic and macroscopic level.

- Distinguish interrelations between the molecular, microscopic and macroscopic descriptions of transport phenomena.

- Explain similarities and differences between the descriptions of the combined fluxes and the equations of change for mass, momentum and heat transport.

- Make appropriate connections between the equations of change and physical phenomena in given systems involving mass, momentum and/or heat transfer processes.

- Apply the method of dimensional analysis to reformulate and then find the form of solutions of the equations of change, to determine the dependence of the interfacial fluxes on system parameters.

- Apply the principle of geometric similarity and dynamic similarity to design scale-up or down experimental system to investigate mass, momentum and/or heat transport processes.

- Elaborate conceptual and mathematical models, from conservation principles, to complicated systems involving simultaneous mass, momentum, and/or heat transfer processes as well as reactions or other sources/sinks of transport for multi-component mixtures.

Course contents

For both isothermal and non-isothermal systems involving either pure fluids or multi-component mixtures, the following topics will be covered for mass, momentum and heat transfer processes:

- Transport by molecular motion

- Transport in one dimension (shell-balance methods)

- Transport in arbitrary continua (use of general transport equations)

- Transport with two independent variables (potential flow theory and boundary-layer theory)

- Transport in turbulent flow and eddy transport properties

- Transport at interphases

- Transport in large systems (use of macroscopic balances)

- Transport by other mechanisms

Course literature

För varje seminarie, förutom det första, kommer det att vara ett eller två kapitel att läsa och ett problem att lösa. Ordningen för presentationen av kapitel och problem meddelas under det första mötet och kan även finnas på Bilda.

Kurslitteratur:

- "Transport Phenomena", R.B. Bird, W.E. Stewart and E.N. Lightfoot, 2nd Ed., 2007, John Wiley & Sons, Inc.

Övriga referenser:

- "Conduction of Heat in Solids", H.S. Carslaw and J.C. Jaeger, 2nd Ed., 1959, Claredon Press, Oxford, Great Britain.

- "The Mathematics of Diffusion", J. Crank, 2nd Ed, 1975, Claredon Press, Oxford, Great Britain.

Examination

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.

TEN1 - Examination, 9.0 credits, grade scale: G, D, U

INL1 - Hand in Assignments, grade scale: G, U

Oral examination will be given for the course when teaching has been completed, using portfolio and discussing problems to see how successfully you have learned and if the (top 7) intended learning outcomes at the relational level have been well achieved. In addition,

- To pass the course you need to attend 12 of 15 seminars and solve 20 problems of B level or above.

- The assignments must be handed in prior to the stated deadlines and you must actively participate at the seminars in which they are assessed.

- If you miss a seminar you have two options:

1) Normally, you are invited to the corresponding lecture when the course is given the next time.

2) Alternatively, you can email the course leader and hand in a written report to discuss the main contents of the lecture you missed.

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.