LUND INSTITUTE OF TECHNOLOGY
Lund University

Department of Energy Sciences
Division of Heat Transfer

MVK 160

HEAT and MASS TRANSFER

Information for students

2009

Lund March 2009

Aim

The course aims to provide deeper knowledge, a wider scope and improved understanding of the mechanisms in heat and mass transfer as well as a better insight into analytical and empirical methods applied in analysis and synthesis of heat and mass transfer related problems. The students should gain knowledge to apply the theories to relevant engineering problems.
The course is a continuation and extension of the basic heat transfer course MMV031 Heat Transfer.

Contents of the course

Heat conduction
Periodic heat conduction, melting-/solidification, permeable materials, anisotropic materials.

Convection
General energy equation, heat transfer at high velocities (viscous heating), heat transfer in rarefied gases (low density heat transfer), and porous media.

Process integration
Optimization of heat exchanger networks with respect to heat recovery (pinch technology). Grassroot design, retrofit design, and introduction of heat pumps are exemplified.

Mass transfer
Diffusive mass transfer in solids, convective mass transfer and combined heat and mass transfer. Mass transfer with and without chemical reactions (combustion) is illustrated.

Thermal radiation
Introduction of the radiation transfer equation (RTE) for handling participating media like gases and liquids.

Fuel cells
Fuel cell (FC) technology is an engineering technology for electric power generation for stationary, mobile and portable power applications. A number of transport phenomena like momentum, mass, energy transports as well as chemical reactions occur. Indeed flow in porous media and thermal radiation (for high temperature FC) take place. The lectures will explain all.

Organisation

The course is given in form of lectures with illustrating examples, home assignments and a small project. The examples and home assignments aim to give proficiency in applying the theories on engineering problems. The project aims to provide a further improved understanding and better insight in analysis some heat or mass transfer related topic.

Literature

The course literature consists of excerpts from the international literature, compendia material, and computer software for the pinch technology.
The literature package is sold at the price, 200 SEK at the division of Heat Transfer (Department of Energy Sciences), 5th floor, room 5118, M-building.
Gunvi Andersson, (email: Gunvi.Andersson@energy.lth.se, phone 046-2228610) is the course administrator.

Examination

All home assignments must receive the grade passed. The exam will include a theoretical part which is to be completed with closed books. Another part of the exam will consist of problems to be solved. The book and other course material except solved problems will then be permitted. The exam encompasses 50 units (50p) and at least 20 units (20p) are required to pass the exam.
Grade 3: 40 %, grade 4: 60 % and grade 5: 80 % of total units.
Time and location for the examination: **Tuesday, May 26 2009 at 8-12am, M:M2**.

Home assignments

The home assignments consist of solving a number of problems, theoretical ones and problems to be solved numerically. **Note: All assignments are compulsory.**
If the assignments are delivered in a correct form before May 22 2009 a bonus of 2 units (2p) on the examination (in total 50p) will be granted.

Project

The project will include a short literature survey on a relevant topic, analysis and calculations. The project shall be presented in form of a written report 3-5 pages (8-10 pages for PhD student) based on the supplied template (appendices excluded), and an oral presentation to your course fellows.

Examiner and Lecture

Dr. Docent, Jinliang Yuan, Department of Energy Sciences, LTH
tel 046-222 4813, email: Jinliang.yuan@ energy.lth.se.

Schedule: Lectures

Date/Month	Day/Time	Activity	Contents	Room
16.3 18.3 19.3	Mon. 13-15 Wed. 08-10 Thurs. 10-12	Lecture Lecture Lecture	Introduction/Anisotropic heat conduction Periodic heat conduction Periodic heat conduction	M:R M:R M:R
23.3 *25.3* 26.3	Mon. 13-15 *Wed. 08-10* Thurs. 10-12	Lecture *Home Study* Lecture	Project start/ Pinch technology *Heat cond.-Moving Boundaries (Ch. 2)* Process integration-Pinch technology	M:R - M:R
30.3 *01.4* 02.4	Mon. 13-15 *Wed. 08-10* Thurs. 10-12	Lecture *Home study* Lecture	Energy eqn/ Heat transfer at high velocities *Heat cond..-Moving Heat Sources (Ch. 3)* Mass transfer	M:R - M:R
27.4 *29.4* 30.4	Mon. 13-15 *Wed. 08-10* Thurs. 10-12	Lecture *Home study* Lecture	Mass transfer *Heat cond. - Permeable materials (Ch. 4)* Heat transfer in rarefied gases	M:R - M:R
04.5 *06.5* 07.5	Mon. 13-15 *Wed. 08-10* Thurs. 10-12	Lecture *Home study* Lecture	Heat transfer in rarefied gases *Heat cond. - Permeable materials (Ch. 4)* Transport Phenomena in Fuel Cells	M:R - M:R
11.5 13.5 14.5	Mon. 13-15 *Wed. 08-10* Thurs. 10-12	Lecture *Home study* Lecture	Thermal radiation *Porous media (Ch 9)* Transport Phenomena in Fires (Dr. Z. Yan)	M:R - M:R
18.5 20.5	Mon. 13-15 Wed. 08-10	Lecture Project	Old exams Oral presentation of project	M:R M:R
26.5	Tues. 8-12		Examination	M:M2

Jinliang Yuan