MJ2244 Airbreathing Propulsion, Intermediate Course I 6.0 credits

Flygmotorteknik, fortsättningskurs I

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 MJ2244 valid from Spring 2009

Grading scale

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

Education cycle

Second cycle

Main field of study

Mechanical Engineering

Specific prerequisites

MJ1112 Thermodynamics, SG1220 Fluid dynamics, and MJ2241 Introductory airbreathing propulsion.

Language of instruction

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

Intended learning outcomes

The course aims at giving an overview of dedicated aspects in thermal turbomachinery. It will focus on applications in the transport sector (aero engines, gas turbines for ship and train propulsion) and the energy sector (steam and gas turbines for power generation).

After completing the course the student will be able to

- Explain the 2D and 3D steady flow phenomena in turbomachine components
- Understand the unsteady flow phenomena in turbomachines
- Understand the major turbomachinery blade design philosophies
- Perform simple aerodynamic designs
- Explain the interaction of fluid and structure
- Understand basic aeromechanical design aspects
- Perform preliminary calculations of mechanical integrity
- Understand gas turbine combustor principles and challenges
- Discuss cooling technologies
- Choose appropriate materials for turbomachinery applications
- Understand operational aspects of thermal turbomachines
- Discuss the content of a scientific article on an advanced level
- Discuss technically today's and tomorrow's challenges related to thermal turbomachines

Course contents

The course is tailored as continuation course for MJ2241 Introductory airbreathing propulsion and therefore starts on an advanced level. Starting from simple 1D analysis of turbomachine components the view is extended to 2D and 3D aspects. Experimental data, CFD and hands-on lab exercises are combined to give the students a profound understanding of flow phenomena in turbomachines.

Dedicated aspects such as gas turbine cooling technology, mechanical integrity, materials and system behavior are elucidated and brought into context.

Critical reviews of scientific articles will be performed to trigger discussions in an interdisciplinary environment. Calculation exercises will be performed to deepen the understanding of treated phenomena. A study visit is foreseen to a major gas turbine manufacturer.

The course is given in English

Course literature

Main course literature

Fransson, T.H., et al., 2005, "Computerized Educational Program", KTH, Heat and Power Technology

In additional handouts of lecture material will be made available through Bilda.

Additional recommended reading

Cohen, H., Rogers, G.F.C, Saravanamuttoo, H.I.H., 1996 "Gas Turbine Theory" Fourth edition, Longman group, Harlow, UK, 1996,ISBN 0-582-23632-0

Preparatory reading

Dixon, S.L., 1998"Fluid Mechanics and Thermodynamics of Turbomachinery" Fourth edition, Butterworth-Heinemann, Woburn, MA, USA, 1998, ISBN 0-7506-7059-2

Examination

- LAB1 - Laboratory Work, 1.5 credits, grading scale: P, F
- TEN1 - Written exam, 4.5 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

A written exam (TEN1; 4,5 cr) and lab work (LAB1; 1,5 cr).

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.