SG1216 Thermodynamics 6.0 credits

Termodynamik

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 SG1216 valid from Spring 2016

Grading scale

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

Education cycle

First cycle

Main field of study

Technology

Specific prerequisites

Course participants are assumed to have successfully completed their first year of studies in Vehicle Engineering as well as the course SG1217 Fluid Mechanics.

Language of instruction

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

Intended learning outcomes

To introduce fundamental concepts and phenomena in thermodynamics with compressible flow. The course provides a foundation for further studies in the third and fourth years of the degree programme.

After this course the student should be able to:

- apply the first and second law of thermodynamics in analysing general energy conversion processes, in particular processes relevant for engines, ships and aeroplanes
- conduct thermodynamic calculations on liquids and perfect gases in applications relevant for vehicle technology, in particular incompressible and compressible flows
- explain the resource consumption taking place in energy conversion processes, in particular those in engines, ships and planes
- relate thermodynamic concepts and computational results to energy economy and the possibility to extract work from different energy resurces and to explain the importance of such knowledge in striving for a sustainable development

More concretely the student should be able to:

- define a thermodynamic system and identify its exchange with the surrundings
- calculate the work performed by an arbitrary p-V system in reversible and isochoric, isobaric or polytropic processes
- calculate transmitted heat using specific heat capacities
- calculate the work performed by a perfect gas in reversible and isothermal or adiabatic processes
- apply Joules law to relate changes in internal energy and enthalpy to changes in temperature in a perfect gas
- perform calculations on energy and exergy budgets for processes in closed and open systems, and explain the meaning of such a calculation for energy economy
- apply the second law of thermodynamics in the analysis of an energy conversin process, as e.g. a generalized heat engine
- acquire the terminology of thermodynamics both in English and Swedish.

By taking this course in thermodynamics the student should develop his/her ability to:

- indentify the role of technology in sustainable technology
- think critically
- understand the axiomatic approach within the general and basic sciences
- reason stringent and generally
- independently formulate mathematical models of physical problems
- draw relevant conclusions from these models
- read and understand technical English

Course contents

The first and Second Laws of Thermodynamics together with the concepts; inner energy, work, heat transfer, enthalpy, entropy, and exergy. The three phases of matter. Ideal gases. Compressible flow through nozzles. Shock waves.

Practical

An obligatory practical exercise with a heat engine is carried out by students in groups of four.

Project

Students are required to carry out a project task based on active participation in the tutorials and the practical exercise.

Course literature

Young & Freedman, ”University Physics”

Nakayama & Boucher, “Introduction to Fluid Mechanics”, Butterworth-Heineman, 1999.

Kompendium

Examination

- INL1 - Hand in Task, 1.5 credits, grading scale: P, F
- KON1 - Control Test 1, 1.5 credits, grading scale: P, F
- KON2 - Control Test 2, 1.5 credits, grading scale: P, F
- LAB1 - Laboration, 1.0 credits, grading scale: P, F
- TEN2 - Examination, 0.5 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.

Other requirements for final grade

Homework (1,5 university credits.).
Practical (1,0 university credits.).
Written examination (1,5+1,5+0,5 university 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.