



LUNDS UNIVERSITET
Lunds Tekniska Högskola

Course syllabus

Statistisk termodynamik med tillämpningar Thermodynamics with Applications

FMFF06, 7,5 credits, G2 (First Cycle)

Valid for: 2023/24

Faculty: Faculty of Engineering, LTH

Decided by: PLED N

Date of Decision: 2023-04-17

General Information

Main field: Technology.

Compulsory for: F2

Language of instruction: The course will be given in Swedish

Aim

Thermodynamics is a basic theory in Physics that has applications in most fields in applied physics and technical physics. The aim of the course is to give applications as well as a basis for further studies in for example atomic physics, combustion physics and solid state physics.

In the first part the basics of thermodynamics in statistical form will be taught. The student will then apply and deepen his/her knowledge by a project. The projects are coupled to research fields which have strongly contributed to develop research fields within “sustainable development” connected to a sample of indicators by SCB : “Sustainable consumption and production”, “Environment and climate”, and “Global development”. Understanding and basic knowledge in the studied field is of importance to develop a sustainable society.

Learning outcomes

Knowledge and understanding

For a passing grade the student must

- describe the basic assumptions in statistical thermodynamics
- understand and describe the postulates in thermodynamics
- be able to describe the principles of heat engines, cooling machines and heat pumps

- explain how such fundamental conceptions as entropy and efficiency in thermodynamic systems relates to each other.
- perform theoretical calculations for various heat engines for the determination of efficiency with the help of PV-diagrams
- from a scientific view point be able to analyse given problems in the field Sustainable Development.

Competences and skills

For a passing grade the student must

- be able to analyse and make calculations in simple thermodynamic systems and account for thermodynamic cycles in various heat engines
- be able to do a project where knowledge in thermodynamics is applied on a concrete problem
- be able to evaluate the result of the project on economy, environment, climate or on global development
- be able to write a scientific/technical report using correct and relevant scientific referencing.
- be able to give a oral presentation of the project

Judgement and approach

For a passing grade the student must

- understand the importance of evaluation of a problem in the field Sustainable Development from different aspects
- understand the dependence between different parts of the society to achieve a sustainable development

Contents

Thermodynamics: Energy, work and heat. Isothermic and adiabatic processes in gases. Entropy. Temperature and equilibrium. PV-diagrams and efficiency of various heat engines and efficient use of energy. The Boltzmann factor. Ideal quantum gases and Fermi gases in low temperatures. Combustion Physics.

Lectures to inspire dealing with specific problems as well as questions in the field sustainable development. The Projects give deeper knowledge in a subject that is relevant for sustainable development, such as thermochemical reactions, renewable energy, efficient energy consumption, energy storage or climate physics.

Schedule of the course: LP 1 Autumn: Lectures and exercises. A laboratory work, "Kretsprocessor". It ends with an examination for this part. LP2 Autumn: An introductory lecture and a laboratory work "Combustion", then a project which will be examined in groups. Lecture that describes how to write a scientific/technical report. Each project shall be reported by a written and a verbal presentation of the project.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)

Assessment: Written exam and project work. Passed laboratory reports. Oral and written presentations of project. The final grade is computed from the sum of the written exam and project grades, where the sum 6-7 gives the final grade 3, the sum 8 gives the final

grade 4 and the sum 9-10 gives the final grade 5.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Parts

Code: 0121. **Name:** Thermodynamics.

Credits: 3,5. **Grading scale:** TH. **Assessment:** Written examination. **Contents:** Thermodynamics

Code: 0221. **Name:** Project - Sustainable Development.

Credits: 3. **Grading scale:** TH. **Assessment:** Written and oral report on project. **Contents:** Project in sustainable development

Code: 0321. **Name:** Laboratory Work.

Credits: 1. **Grading scale:** UG. **Assessment:** Passed laboratory sessions.

Admission

Assumed prior knowledge: FAFA55 Concepts in Quantum Physics.

The number of participants is limited to: No

The course overlaps following course/s: FMFF05

Reading list

- Compendium: Statistical Thermodynamics.

Contact and other information

Course coordinator: Marcus Dahlström, marcus.dahlstrom@matfys.lth.se

Course homepage: <http://canvas>

Further information: Some elements may be taught and assessed in English. This includes a maximum of 1.5 hp, in the form of laboratory sessions or written assignments.