

ME-351

Thermodynamics and energetics II

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Cursus	Sem.	Type
Mechanical engineering minor	E	Opt.
Mechanical engineering	BA6	Opt.

Language of teaching	English
Credits	3
Session	Summer
Semester	Spring
Exam	Written
Workload	90h
Weeks	14
Hours	3 weekly
Lecture	2 weekly
Exercises	1 weekly
Number of positions	

Summary

This course will discuss advanced topics in thermodynamics with a focus on studying gas phases, mixtures, phase transformations and combustion. The application of these principles to various practical systems such as batteries, fuel cells etc. will be discussed.

Content

- Review of the mathematical structure of thermodynamics
- Characteristic potentials for arbitrary boundary conditions
- Introduction to phases and phase diagrams
- Thermodynamics of mixtures, gases and phases
- Thermodynamics of stressed solids
- Combustion
- Statistical Mechanics
- Applications of thermodynamics to batteries, fuel cells, shape-memory, piezoelectric materials etc.

Learning Prerequisites**Required courses**

Required Courses:

Thermodynamics and Energetics I

Recommended Courses:

Various courses in the institute of materials, mechanics and physics

Learning Outcomes

By the end of the course, the student must be able to:

- Explain and apply the concepts of energy storage (heat, electricity, inertia)
- Describe and explain the main thermodynamic cycles
- Explain and apply the concepts of thermodynamic efficiency
- Explain the principles and limitations of the main energy conversion technologies
- Choose suitable methods and tools for (a) the development of, (b) the modelling and simulation of, (c) the analysis of and (d) the choice of solution for an engineering problem in the mechanical engineering domain (product design, manufacturing process and system production)

Transversal skills

- Demonstrate the capacity for critical thinking
- Plan and carry out activities in a way which makes optimal use of available time and other resources.

Teaching methods

Ex cathedra, videos and exercises

Assessment methods

Final written exam (60%)

Mid-term exam (40%)

Resources**Bibliography**

Principles of Classical Thermodynamics: Applied to Materials Science Didier de Fontaine

Fundamentals of engineering thermodynamics Moran and Shapiro

Introduction to the Thermodynamics of Materials David Gaskell

Ressources en bibliothèque

- [Principles of Classical Thermodynamics: Applied to Materials Science Didier de Fontaine](#)
- [Introduction to the Thermodynamics of Materials David Gaskell](#)
- [Fundamentals of engineering thermodynamics Moran and Shapiro](#)

Moodle Link

- <https://go.epfl.ch/ME-351>