ME-351

# Thermodynamics and energetics II

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

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|---|---|
| Language of teaching | English |
| Credits | 3 |
| Session | Summer |
| Semester | Spring |
| Exam | Written |
| Workload | 90h |
| Weeks | 14 |
| **Hours** | **3 weekly** |
| Courses | 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
- 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
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### Moodle Link

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