ME-251

Thermodynamics and energetics I

Haussener Sophia

Cursus	Sem.	Type
Mechanical engineering	BA3	Obl.

Language of teaching	English
Credits	4
Session	Winter
Semester	Fall
Exam	Written
Workload	120h
Weeks	14
Hours	**4 weekly**
Lecture	3 weekly
Exercises	1 weekly
Number of positions	

Summary

The course introduces the basic concepts of thermodynamics and heat transfer, and thermodynamic properties of matter and their calculation. The students will master the concepts of heat, mass, and momentum conservation, and apply these concepts to thermodynamic cylces and energy conversion systems.

Content

Generalities and fundamentals: Thermodynamic systems, 0th Law, Energy and the First Law, Entropy and the 2nd Law, 3rd Law, Gibbs equations.
Closed systems and basic relations: Fundamental equations for homogeneous closed systems, Specific heats,, Mathematical relations between state functions.
Open systems in steady-state: Elements of gas dynamics, Nozzles, Turbine and compressor efficiencies, etc.
Thermodynamic properties of matter: State and state changes, Kinetic gas theory, Perfect gas and ideal gas, State equations (Van der Waals, etc.), Approximate relations for liquid and solids.
Thermodynamic processes and diagrams: T-s, h-s, p-v diagrams.
Exergy: Definition and exergy balance.
Elementary energy systems analysis applied to reversible cycles and of simple real cycles: Generalities, General properties of cycles, Cycles with two thermal sources for engines and heat pumps, Power cycles, Heat pump cycles, Refrigeration cycles

Keywords

Thermodynamics, energy, matter, cycles

Learning Outcomes

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

- Compute the thermodynamic properties of a fluid, E2
- Compute the main thermodynamic transformations of compressible and incompressible fluids, E4
- Formulate mass, energy, and momentum balances, E1
- Elaborate on limitations of the main energy conversion technologies, E7
- Distinguish the main thermodynamic cycles, E5
- Integrate the concepts of thermodynamic efficiency, E6

Transversal skills

- Respect relevant legal guidelines and ethical codes for the profession.
- Access and evaluate appropriate sources of information.

- Take responsibility for environmental impacts of her/ his actions and decisions.
- Take responsibility for health and safety of self and others in a working context.

Assessment methods

Written exam at the end of the semester

Resources

Bibliography

Moran, Shapiro et al., Fundamentals of Engineering Thermodynamcis, John Wiley & Sons, 2011
Borel, Favrat Thermodynamics and energy systems analysis I, EPFL Press, 2010
Borel, Favrat et al. Thermodynamics and energy systems II, EPFL Press, 2011

Ressources en bibliothèque

- Fundamentals of Engineering Thermodynamcis / Moran
- Thermodynamics and energy systems analysis / Borel