

ME-459

Heat pump systems

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Cursus	Sem.	Type
Energy Science and Technology	MA2, MA4	Obl.
Mechanical engineering minor	E	Opt.
Mechanical engineering	MA2, MA4	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 aims to study heat pumping cycles and technologies, and equipment, such as compressors (positive displacement and dynamic), heat exchangers, and expansion valves.

Content

- Summary of thermodynamics
- Environmental motivations
- Heat pumping technologies: main families of technologies for heat pumping (compression, chemical, magnetic, thermoelectric), working fluids incl. mixtures and global environmental impact factors.
- Equipment: heat exchangers, dynamic and positive displacement compression machines.
- Applications.

Keywords

Heat pumps
Compressor technology

Learning Prerequisites**Required courses**

Thermodynamics and energetics I (ME-251)
Thermodynamics and energetics II (ME-351)

Learning Outcomes

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

- Explain the principles and limitations of the main energy conversion technologies, E7
- Assess / Evaluate and design volumetric and dynamic compressors, E13
- Identify the challenges related to energy: resources, energy services, economic and environmental impacts, E9
- Assess / Evaluate fluid flows in energy conversion systems, compute pressure drops and heat losses and fluid - structure interactions, E10
- Analyze the energy and exergy efficiency of energy systems, E21
- Explain the principles and limitations of the main energy conversion technologies, E7

Teaching methods

Ex-cathedra
Examples in class
Exercises

Assessment methods

Written exam

Resources

Bibliography

Borel, Favrat Thermodynamics and energy systems analysis, EPFL Press + distributed documents available in pdf on moodle.

Moodle Link

- <https://go.epfl.ch/ME-459>