ME-459

Thermal power cycles and heat pump systems

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Cursus	Sem.	Type
Energy Science and Technology	MA2, MA4	Obl.
Energy minor	E	Opt.
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 at studying thermal power cycles, heat pumping technologies, and equipment.

Content

- Thermal power cycles : Rankine, ORC, Brayton, supercritical, combined cycles, Cheng, Kalina, specific power plant applications (natural gas, coal and biomass incl. IGCC, waste incineration).
- Heat pumping technologies: main families of technologies for heat pumping (compression, chemical, magnetic, thermoelectric), working fluids incl. mixtures and global environmental impact factors.
- Equipment: boilers, heat exchangers, cooling towers, dynamic and positive displacement compression and expansion machines.

Keywords

Power plant, heat pump, compressor, turbine.

Learning Prerequisites

Required courses

- Thermodynamics I
- Thermodynamics II

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 compressors and turbines, 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 industrial energy systems, E21
- Explain and calculate the main emission sources of energy conversion processes, E23
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Teaching methods

- Ex-cathedra
- Calculation examples in class
- Exercises

Assessment methods

Written examination.

Resources

Bibliography

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

Ressources en bibliothèque

- Thermodynamique et énergétique II / Borel
- Thermodynamique et énergétique I / Borel
- Borel, Favrat Thermodynamics and energy systems analysis

Moodle Link

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