

ME-459

Thermal power cycles and heat pump systems

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Cursus	Sem.	Type
Energy Management and Sustainability	MA2, MA4	Opt.
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
Courses	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 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

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 I / Borel](#)
- [Thermodynamique et énergétique II / Borel](#)