

ME-459

Thermal power cycles and heat pump systems

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

Language of teaching	English
Credits	2
Session	Summer
Semester	Spring
Exam	Oral
Workload	60h
Weeks	14
Hours	2 weekly
Courses	2 weekly
Number of positions	

Remark

pas donné en 2017-18

Summary

This lecture aims at studying Energy (economics and environment: general knowledge), thermal power plant cycles and equipment, nuclear power plants and heat pumping technologies.

Content

Energy, Economics and Environment: general knowledge

Thermal power plant cycles and equipment: Rankine, Brayton, supercritical, combined cycles, Cheng, Kalina, boilers (incl. fluidised bed), turbomachines, cooling towers, specific power plant applications (oil & natural gas, coal incl. IGCC, waste incineration,...)

Nuclear power plants: nuclear physics elements-fission-critical size of a reactor-fuel cycles-specifics of nuclear power plants (physics design, thermohydraulics of the core, control, main types of power plants, environmental aspects, safety)

Heat pumping technologies: main families of technologies for heat pumping (compression, chemical, magnetic, thermoelectric), main compressor and expander technologies (volumetric, dynamic), working fluids and refrigerants incl. mixtures (diagr de Merkel-Bosnjakovic) and the global environmental impact factors

Keywords

Power plant, heat pump, compressor, turbine

Learning Outcomes

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

- Know the principles and limitations of the main energy conversion technologies, E7
- Understand the challenges related to energy: resources, energy services, economic and environmental impacts, E9
- Calculate fluid flows in energy conversion systems, compute pressure drops and heat losses and fluid - structure interactions, E10
- Calculate and design volumetric compressors and turbines, E14
- Analyse the energy and exergy efficiency of industrial energy systems, E23
- Explain and calculate the main emission sources of energy conversion processes, E25

Assessment methods

Oral examination at the end of the course

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](#)