LMECA1855

2014-2015

Thermodynamics and energetics.

5.0 credits	30.0 h + 30.0 h	1q

Teacher(s) :	Papalexandris Miltiadis ; Bartosiewicz Yann ;
Language :	Français
Place of the course	Louvain-la-Neuve
Inline resources:	> http://icampus.uclouvain.be/claroline/course/index.php?cid=MECA2855
Main themes :	- Compression and expansion of gases - Thermodynamics of vapours, humid air, and Fuels - Introduction to heat transfer - Brayton, rankine and combined cycles - Refrigeration engines. - Gas turbines - introduction to combustion. - Fundamentals of heat exchangers
Aims :	Based on the appropriate scientific fundamentales in physical-chemistry and thermodynamics, this course aims at introducing important applications of technical thermodynamics. It also aims at providing the student with the operational basis for thermodynamic calculations and evaluation of energy systems. *The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".*
Evaluation methods :	A significant part of the final note is related to continuous evaluation achieved during the practical sessions.
Teaching methods :	The teaching is focussed on the practical sessions. A regular attendance of these practical sessions is required from all students.
Content :	Basic aspects of technical thermodynamics: balance equations of the motive power, ideal gas, properties of gaseous systems, entropic diagrams, simple transformations of state, irreversibilities, work of friction in straight pipes, singular pressure drops. Compression and expansion: energy balances, isentropic and polytropic efficiencies, compressors, fans, turbines, axial and radial engines, characteristic curve of a turbomachine, of a circuit, compressors with intermediate cooling. Thermodynamics of vapors: phase change, determination of the state variables, thermodynamic diagrams and tables. The humid air: particular characterisation formalism, Mollier diagramme, limit cooling temperature of water in contact with humid air. Fuels: characteristic quantities, combustion products, properties of use of the main fuels, characterisation of the combustion, boilers and burners, efficiency of a boiler and of a furnace. Heat exchangers: Fourier law, convection coefficient, overall coefficient of heat transfer through a wall, parallel or counter-current tubular heat exchanger, efficiency of a heat exchanger. Gas turbines: calculations of the thermodynamic cycle, optimisation, static applications. Power generation with steam: Rankine-Hirn cycle, power cycle with superheat and reheat, cycle with feedwater heaters, global efficiency, main equipment of power plants with fossil fuels, particular aspects of the cycle of nuclear power plants, main equipment of nuclear power plants. Fast breeders. Gas-steam combined cycles. Refrigeration engines : simple cycle, selection criteria of the thermodynamic fluid, cycle with double compression and double expansion, cascade cycles. The heat pump. Practical sessions: they include exercises, lab sessions, and project work. The pedagogical methods used aim at developing a sound understanding of the physics of the physical phenomena involved and knowledge of the systems which enable to achieve the thermodynamic processes.
Bibliography :	-- M. J. Moran, H.N. Shapiro : Fundamentals of Engineering Thermodynamics, John Wiley, 1995.
Cycle and year of study :	> Bachelor in Engineering > Bachelor in Mathematics
Faculty or entity in charge:	MECA