UCLouvain

lmeca1855

2017

Thermodynamics and energetics.

5 credits	30.0 h + 30.0 h	Q1

Teacher(s)	Bartosiewicz Yann ;Papalexandris Miltiadis ;
Language :	French
Place of the course	Louvain-la-Neuve
Main themes	• Thermodynamics of ideal gases • Introduction to heat transfer and to heat exchangers • Phase equilibria, change of phase. • Gas turbines • Refrigeration engines • Compression and expansion of gases • Pressure losses • Humid air • Introduction to Rankine cycles
Aims	In consideration of the reference table AA of the program "Masters degree in Mechanical Engineering", this course contributes to the development, to the acquisition and to the evaluation of the following experiences of learning: 1 • AA1.1, AA1.2, AA1.3 • AA2.1, AA2.2, AA2.5 • AA3.2, AA3.3 • AA5.1, AA5.5, AA5.6 • AA6.1, AA6.4 - - - - *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	Written exam consisting of theoretical questions (duration 1.5 hours) and exercises (duration 2.0 hour). The exam is with closed books and notes but a list of useful relations is provided for the exercises. The score on the theoretical questions of the exam counts for 50% of the overall score. The score on the exercises of the exam counts for 50% of the overall score.
Teaching methods	• Course lectures • Session of exercises
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, regular/singular pressure drops. • Compression and expansion: energy balances, isentropic and polytropic models/efficiencies, compressors, fans, turbines, axial and radial engines, kinematic analysis, characteristics curve of a turbomachinery, of a circuit, working point stability, compressors with intermediate cooling. • Thermodynamics of vapors: phase change, determination of the state variables, thermodynamic diagrams and tables. • The humid air: formalism, absolute/relative humidity, dry/wet bulb temperature, Mollier chart, air-water mixtures, humid air mixing • 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, main components, energy analysis, energy balance over each component, efficiency, physical/thermodynamic constraints, introduction to exergy analysis • 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. • 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
Inline resources	http://moodleucl.uclouvain.be/enrol/index.php?id=4853

Bibliography	• Notes du cours LMECA1855, disponibles sur le site i-campus du cours et au SICI. **Obligatoire.** • Transparent du cours magistral, disponibles sur le site i-campus du cours. **Obligatoire.** • Ennoncés d'exercices, disponibles sur le site i-campus du cours. **Obligatoire**. • Eléments de thermodynamique technique, J. Martin, P. Wauters, Presses universitaires de Louvain, 2014. **Conseillé** • M. J. Moran, H.N. Shapiro : Fundamentals of Engineering Thermodynamics, John Wiley, 1995. **Conseillé**
Other infos	Lecture notes of the course LMECA1855, available on the i-campus site of the course and ay SICI.
Faculty or entity in charge	MECA

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Aims
Minor in Engineering Sciences: Mechanics	LMECA100I	5		