UCLouvain

lmeca1855

2020

Thermodynamics and energetics.

Due to the COVID-19 crisis, the information below is subject to change, in particular that concerning the teaching mode (presential, distance or in a comodal or hybrid format).

5 credits	30.0 h + 30.0 h	Q2

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	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** Written exam consisting of theoretical questions and exercises. The exam is with closed books and notes. 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. We maintain the right to ask a student for an oral exam in case of technical problems or suspicion of fraude.
Teaching methods	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** • Course lectures • Session of exercises • Lectures in the classroom or mixed (classrooms with simultaneous broadcasting on Teams) depending on the pandemic conditions
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 • Introduction to combustion : phenomenology of combustion, balance equation and stoichiometry, coefficients of the quality of combustion, heat of combustion, heating value of fuels, adiabatic combustion temperature, main pollutants produced by the combustion of fuels. • 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, complex cycles including bleeding and reheating

	• 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	https://moodleucl.uclouvain.be/course/view.php?id=4853
Bibliography	• Notes du cours LMECA1855, disponibles sur le site Moodle du cours et au SICI • Transparent du cours magistral, disponibles sur le site Moddle du cours • Ennoncés d'exercices, disponibles sur le site Moddle du cours • Eléments de thermodynamique technique, J. Martin, P. Wauters, Presses universitaires de Louvain, 2014. • M. J. Moran, H.N. Shapiro : Fundamentals of Engineering Thermodynamics, John Wiley, 1995. • Notes du cours LMECA1855, disponibles sur le site Moddledu cours et au SICI. **Obligatoire.** • Transparent du cours magistral, disponibles sur le site Moodle du cours. **Obligatoire.** • Ennoncés d'exercices, disponibles sur le site Moodle 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 Moodle site of the course and ay SICI.
Faculty or entity in charge	MECA

Force majeure

Teaching methods	Due to the pandemic, the class lectures and exercise sessions in 2020-21 will take place on line, via Teams.

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Aims
Minor in Mechanics	LMINOMECA	5		
Specialization track in Mechanics	FILMECA	5		
Minor in Engineering Sciences: Mechanics (only available for reenrolment)	MINMECA	5		