UCLouvain

lelme2150

2022

Thermal cycles

5.00 credits	30.0 h + 30.0 h	Q1

Teacher(s)	Bartosiewicz Yann ;
Language :	English > French-friendly
Place of the course	Louvain-la-Neuve
Prerequisites	Students are expected to master the following skills: basics in thermodynamics and fluid mechanics , as they are covered within the courses LMECA1855 and LMECA1321
Learning outcomes	**At the end of this learning unit, the student is able to :** 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: • AA1.1, AA1.2, AA1.3 • AA2.1, AA2.2, AA2.3, AA2.4 • AA3.1, AA3.2, AA3.3 • AA4.1, AA4.2, AA4.3, AA4.4 • AA5.1, AA5.3, AA5.4, AA5.5, AA5.6 • AA6.3 1 The student will acquire the necessary knowledge to understand, design and evaluate thermodynamic systems involved in power cycles. A the end of the course he/she will be able to: • Use the concept of exergy to evaluate the performance of a power cycle and complete the energy approach • To formulate a detailed analysis of losses and irreversibilities at each component of a power cycle and present results by plots/pie charts • To elaborate assumptions and setup models to simulate a steam, gas and combined cycles • To setup a user friendly software with a GUI to simulate a complex combined cycle up to 3 pressure levels and performing energy/exergy analysis
Evaluation methods	THe final evaluation relies on a mixt approach (i) continuous and (ii) in session exam: (i) Continuous evaluation: • During the quadrimester, different **mandatory** homeworks (by group of two students), with progessive difficulty, will be required. They will consist in developing models and implementing them in the form of computer codes and to write a calculation note (small report). Those homeworks will be linked each others as thsy will will to tackle basics cycles, to further adding complexities and going more in-depth into the analysis according what has been seen in lectures. An oral presentation of the homeworks will be required at the end of the quadrimester. These reports together with the codes, and oral presentation will make an "homework" mark (/20). • Moreover, some "quizz" will be also organized in class (closed book) in order to assess the learning outcomes of the previous lectures. Those "quizz" will make a "quizz" mark (/20). (ii) Exam: • During the exam session a written exam, closed book, will be organized. Questions will be written in english. This will make an "exam" mark (/20). The final mark will be calculated as follows: • Final mark (/20) = MIN(exam (/13) + bonus "quizz" (/2) + "homework" (/7), 20) if the exam mark is larger than 6/20 • Final mark (/20) = (exam (/20)) if the exam mark is lower or equal than 6/20 • Any homework that should be not delivered in due time will receive a mark of 0/20 • The "quizz" bonus will depend on the "quizz" mark and will be in the range 0/2 - 2/2. If a student has a non-justified abscence to more than 50% of the quizz, this will involve a "quizz" mark of 0/2. • A failed mark in "quizz" does not prevent the student to reach the maximum final mark (20/20) In case of a second exam session, the same rules apply (the marks for the "homeworks" and "quizz" will be kept).

Teaching methods	The detailed slides of all lectures will be availble since the very beginning of the course (Moodle). The students are expected to study the slides and the related book (compulsory reference) chapter/sections prior the class. This will allow the professor to focus the inclass lecture on the main learning outcomes of each part and to treat typical exam questions when applicable. Moreover, this will also avoid to waste time for details or uneccessary developments and thus this will allow students to have a clear view on what knowledge is expected for the evaluation. Q&A sessions will be also organized to come back on details or to remedy to any missunderstandings. Attendance is highly recommended as a permanent link between models/theory/formula and practical/technological arrangements is explained during the class. The spirit of the course is a permanent comparison between the classical energy approach and the exergy analysis to analyse and improve energy production cycles.
Content	• Chapter 1: characterization of performances of driving engines • Chapter 2: Steam power cycles (Rankine-Hirn) • Chapter 3: Gas power cycles (Brayton) • Chapter 4: Combined gas-steam cycles (CCGT) • Chapter 5: Combined heat and power cycles (CHP)
Inline resources	https://moodle.uclouvain.be/course/view.php?id=829
Bibliography	• Thermal Power Plants - Energetic and Exergetic approaches", D. Johnson, Joseph Martin et Pierre Wauters, 2015, presses universitaires de Louvain, ISBN: 978-2-87558-408-3 (978-2-87558-409-0 en pdf) . **Obligatoire** • Slides disponibles sur Moodle **obligatoire** • Eléments de thermodynamique technique",Joseph Martin et Pierre Wauters, 2014, presses universitaires de Louvain (ISBN:978-2-87558-317-8 or 978-2-87558-318-5 en pdf) . **Recommandé** • Thermodynamique et énergétique: de l'énergie à l'exergie", L. Borel et D. Favrat, Presses polytechniques et universitaires romandes. **Recommandé** • "Thermal Power Plants - Energetic and Exergetic approaches", D. Johnson, Joseph Martin et Pierre Wauters, 2015, presses universitaires de Louvain, ISBN: 978-2-87558-408-3 (978-2-87558-409-0 in pdf). **Obligatoire** • "Eléments de thermodynamique technique",Joseph Martin et Pierre Wauters, 2014, presses universitaires de Louvain (ISBN:978-2-87558-317-8 or 978-2-87558-318-5 in pdf). **Recommandé** • Slides disponibles sur Moodle, **obligatoire** • "Thermodynamique et énergétique: de l'énergie à l'exergie", L. Borel et D. Favrat, Presses polytechniques et universitaires romandes. **Recommandé**
Faculty or entity in charge	ELME

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Mechanical Engineering	MECA2M	5		🔍
Master [120] in Electro-mechanical Engineering	ELME2M	5		🔍