UCLouvain

lelme2150

2023

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	Final assessment is based on a mixed approach of (i) continuous assessment and (ii) in-session examination: (i) Continuous assessment: • During the four-month term, students will be required **(mandatory)**to complete several homework assignments (in pairs) of progressive difficulty. They will consist in developing a model and implementing it in the form of a calculation code, and in submitting a calculation note and the code. These homeworks will be linked, starting with basic cycles, and progressing to more complex cycles and their analysis over the course of the term, in line with the material covered in class. An oral presentation will be required at the end of the session. These assignments will be graded (/6) "assignments". The oral presentation will be graded (/5) "oral". • In addition, quizzes will be organized in class to test the learning acquired in previous courses. These quizzes will be graded (/4) "quizz". (ii) In-session examination: • An in-session closed-book written exam will be held to establish a grade (5) "exam". The final grade will be calculated as follows: • Final grade (/20) = exam (/5) + quizz (/4) + assignments (/6) + oral (/5), if exam grade is greater than or equal to 2.25/5 • Final grade (/20) = exam grade (/5)x4 if exam grade less than 2.25/5 • Any homework not handed in on time will be awarded a mark of 0/20. • Non-participation in a quizz will result in a score of 0 for that quiz. • Any unjustified absence from more than 50% of quizzes will result in a quiz mark of 0/4. In the event of a second session, the same rules apply (quiz, homework and oral marks are retained).

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. 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**
Other infos	**Note on the use of generative artificial intelligence:** • The use of generative AI is tolerated, but its use must be thoughtful, critical and ethical. • The student is required to systematically indicate all parts in which AIs have been used, e.g. in footnotes, specifying whether the AI was used to search for information, to write or correct the text, or to generate computer code. Sources of information must be systematically cited in accordance with bibliographic referencing standards. Students remain responsible for the content of their work, regardless of the sources used.
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 Energy Engineering	NRGY2M	5		
Master [120] in Electro-mechanical Engineering	ELME2M	5		