UCLouvain

lmapr2691 — Technology of chemical and environmental engineering

2021

5.00 credits	30.0 h + 15.0 h	Q2

Teacher(s)	Luis Alconero Patricia ;Winckelmans Grégoire ;
Language :	English
Place of the course	Louvain-la-Neuve
Learning outcomes	**At the end of this learning unit, the student is able to :** 1 **Contribution of the course to the program repository:** Referring to the learning outcomes of the KIMA degree, the following AAs are targeted: Axis 1: 1.1, 1.2; Axis 2: 2.2, 2.3, 2.4, 2.5; Axis 3: 3.1, 3.2, 3.3; Axis 4: 4.1, 4.2, 4.4; Axis 5: 5.3, 5.5, 5.6; Axis 6: 6.1, 6.2, 6.3. **Course specific learning outcomes** **Technical Learning Outcomes** At the end of this course, the student will be able to: • Calculate the pressure loss in straight and curved tubes. • Classify pumps and compressors. • Choose a type of pump / compressor according to its use. • Calculate and correctly interpret the maximum load height of a pump and the characteristic curve of a pump. • Analyze the characteristic behavior of pumps in series or in parallel. Calculation of discharge heights and discharge rates. • Analyze serial compression. • Derive and use compression models, compute compression power and efficiency, and analyze and calculate the characteristics of multi-stage compression. • Take into account a deviation of the perfect gases and determine the exponents of the gases. • Classify the different types of agitators. • Size the most important agitators. • Classify the different types of heat exchangers. • Size the most important heat exchangers. • Realize the diagram of a process. • Analyze the safety and regulation of a process. • Perform the thermodynamic analysis of the processes. **Cross-Curricular Outcomes:** At the end of this course, the student will be able to: • Contribute, as a team, to the realization of a disciplinary or multidisciplinary project respecting a framed approach. • Use a body of knowledge in basic and polytechnic sciences, to solve disciplined disciplinary problems. • Mobilize scientific and technical knowledge from a variety of sources, including reference books and the web. • Analyze, organize and complete an engineering approach applied to the development of a process that meets a need or a problem, with the analysis of a given physical phenomenon or system. • Demonstrate rigor and critical thinking in their scientific and technical endeavors while being ethical. • Communicate effectively orally and in writing the results of the missions entrusted to him.
Evaluation methods	Exam (theoretical and practical questions). The exam is divided in three parts related to 1) heat exchangers, 2) pump and compressors and 3) exergy analysis. The students have to pass the three parts to credit the course.
Teaching methods	This course combines lectures in class, sessions of exercises in class, and a laboratory
Content	Introduction (2h) : Patricia Luis Exergy (8h) - Patricia Luis • Introduction to exergy • Importance of exergy in Chemical Engineering • Exergy in reaction and separation Pumps and Compressors (8h) - Patricia Luis • Pumps: Fundamentals • Types of pumps and their specificities

	• Compressors: Fundamentals • Types of compressors and their specificities. • Multistage compressors and their benefit Heat Exchangers (8h) - Winckelmans Grégoire • Conduction, convection. Solutions of conduction in 1D: multi-layer plate, multi-shell pipe, fins on plates and fins on pipes. Electrical analogy and thermal resistance. • Heat transfert coefficients. Laminar flows: case with constant heat flux density at the wall, case with constant wall temperature, thermally developed flow and thermal entry length. Correlations for turbulent flows. • Heat exchangers: co-current, couter-current, cross-current. LMTD (Logarithmic Mean Temperature Difference) method. • Epsilon-NTU (Number of Transfer Units) method Safety and Operation (2h) – Solvay • HAZOP analysis
Inline resources	Course notes and/or copies of the slides used in class are provided to students and available on Moodle
Bibliography	For the part on heat exchangers: F. P. Incropera, D. P. Dewitt, T. D. Bergman, A. S. Lavine, « Fundamentals of Heat and Mass Transfer », Sixth edition, 2007. For the part on exergy: I. Dincer, "Exergy: Energy, Environment and Sustainable Development", 2nd Edition, Elsevier, 2012.
Other infos	This course requires basic knowledge of hydrodynamics & transport phenomena, thermodynamics and applied mathematics.
Faculty or entity in charge	FYKI

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Chemical and Materials Engineering	KIMA2M	5		