UCLouvain

lmeca2160

2024

Combustion and fuels

5.00 credits	30.0 h + 30.0 h	Q1

Teacher(s)	Papalexandris Miltiadis ;
Language :	English > French-friendly
Place of the course	Louvain-la-Neuve
Prerequisites	It is expected that the students have mastered the basics of thermodynamics, as covered in the courses LMECA1855 or LPHYS1343, as well as the basics of fluid mechanics, as covered in the courses LMECA1321 or LPHY1213.
Main themes	Origins, nature, and conditioning of fuels. Mass and energy balance laws of combustion. Physical chemistry and chemical kinetics of combustion: reacting schemes and phenomenology of the modes of combustion. Fuel combustion technologies: conception and design of combustion heat transfer equipment.
Learning outcomes	**At the end of this learning unit, the student is able to :** With respect to the reference AA of the programme of studies "Masters degree in Mechanical Engineering", this course contributes to the development and acquisition of the following skills • AA1.1, AA1.2, AA1.3 • AA2.3, AA2.4, AA2.5 • AA3.1, AA3.3 • AA4.1, AA4.2, AA4.3, AA4.4 • AA5.2, AA5.4, AA5.5 1 • AA6.1, AA6.4 **Specific learning outcomes of the course** More specifically, by the end of the course, the student will be able i) to apply the main concepts of the thermo-chemistry of combustion to the evaluation of the quality of combustion in energy systems, including thermal engines. ii) to perform calculations of combustion equipment and associated heat-transfer devices. iii) to understand the environmental aspects of fossil fuel combustion.
Evaluation methods	• i) Exam. The exam consists of exercises. It is written with open books and notes • ii) laboratory report. The laboratory is jointly performed by groups of 2 or 3 students. The members of each group jointly prepare the laboratory report. There is one grade per report, i.e. the students of each group receive the same grade. The participation in the lab and the preparation of the report is **compulsory**. • The grade on the written exam counts for 75% of the overall grade. The grade on the laboratory report counts for 25% of the overall grade. Overall = 0.75 exam + 0.25 lab report. • The grade on the lab report also counts in the August session. • We maintain the right to ask a student for an oral exam in case of technical problems or suspicion of fraude. • Failure to comply with the methodological guidelines defined on moodle, particularly with regard to the use of online resources or collaboration between students, will result in an overall mark of 0 for the lab report. • The use of artificial intelligence tools for the lab report is prohibited.
Teaching methods	• Course lectures • Session of exercises • Laboratory: Operation of a domestic natural-gas boiler and analysis of its combustion efficiency. • Lectures in the classroom with physical presence
Content	**1.Energetic study of fuels and their use.** Origins and formation of fuels. Conditioning and specification of fuels. Global mass and energy balance laws in combustion. Control and diagnostic techniques. **2. Thermochemistry of combustion.** Chemical kinetics of combustion. Chain-branching mechanisms. Explosivity and flammability limits, flame temperature. Chemical reaction rates. Pollutant formation. Measurement techniques. **3. Combustion and heat transfer technologies.** Laminar premixed flames. Introduction to turbulent flows. Turbulent premixed flames and their applications. Use of heat generated by combustion.

	The balance laws of mass and of energy and the physico-chemical calculations are the objects of exercises and laboratory experiments. In these experiments emphasis is placed upon the phenomenology of combustion, control methods and diagnostics and upon operating methods.
Inline resources	https://moodle.uclouvain.be/course/view.php?id=819
Bibliography	• M.V. Papalexandris, *Combustion and Fuels*, Presses Universitaires de Louvain, 2020. **Mandatory**. Available at DUC, Grand-Rue 2/14, 1348 Louvain-la-Neuve • S.R. Turns, *Introduction to Combustion*, Mc Graw Hill, 2000. **Recommended** • K.K. Kuo, *Principles of Combustion*, John Wiley & Sons Ltd., 2005. **Recommended**
Faculty or entity in charge	MECA

Programmes containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Mechanical Engineering	MECA2M	5		🔍