UCLouvain

lelec2670

2020

Renewable and non conventional sources of electrical energy

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).

4 credits	30.0 h + 15.0 h	Q2

Teacher(s)	De Jaeger Emmanuel (coordinator) ;Jacques Pascal ;
Language :	English
Place of the course	Louvain-la-Neuve
Main themes	• Generalities about electrical energy supply • Renewable energy: solar photovoltaic, solar thermal, wind, marine • Storage of electrical energy • Thermoelectric conversion • Magnetocaloric conversion • Fuel Cells
Aims	In consideration of the reference table AA of the program "master in electrical 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 • AA3.1, AA3.2 • AA5.3, AA5.4 • AA6.1, AA6.2, AA6.3 Specifically, at the end of the course, students will be able to : 1 • Discuss the place of electricity in the general frame of energy resources; • Do the preliminary sizing of a power generation facility based on the exploitation of renewable resources (eg photovoltaic); • Model the components of a photovoltaic system (autonomous or connected to an electric power grid: modules, power electronic converters, batteries, regulators, auxiliaries) towards its simulation and optimization; • Understand the operation of wind turbines and their operating issues; • Understand how marine energy converters and systems work; • Understand the energy management and power systems problems linked to the penetration of renewable energy; • Understand the principles of thermoelectric and magnetocaloric conversion; • Address technical and specialized literature on all these topics. - - - - *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.** Students are assessed during an oral examination, for which they can have the courses and their personal notes supports. Exercises (with reports subject to evaluation during the semester) are taken into account for the final grade.
Teaching methods	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** The course consists of lectures that aim to describe the general context, the main concepts, the physical principles involved, the models, the methods of calculation and assessment as well as to provide comments on certain specific technology information. Numerical application exercises (problems) are proposed. Course participants are invited to propose solutions and provide reports in groups of two or three people. These reports are evaluated and discussed. A laboratory is organized on the theme of thermoelectricity
Content	• Introduction: energy context • Introduction to photovoltaic solar: preliminary design of a system (autonomous or connected to the power distribution grid)

	• Aspects of the behaviour of photovoltaic systems in real conditions • Characterization and modelling of photovoltaic modules • Interfaces for photovoltaic modules • Characterization of irradiance, sky modelling • Introduction to solar thermal energy • Introduction to wind turbines; mechanical and electrical aspects (types of generators and grid connection, specific problems) • Introduction to marine energy conversion technologies (tidal power, wave power, tidal current energy, osmotic power) • Energy storage techniques in the context of the exploitation of renewable energy sources • Introduction to the thermoelectric effect • Implementation of thermoelectric converters • Magnetocaloric effect • Implementation outlook of the magnetocaloric effect • Introduction to fuel cells
Inline resources	Moodle http://moodleucl.uclouvain.be/course/view.php?id=5343
Bibliography	• Transparents du cours • Ouvrages de référence disponibles en version électronique à la BST • Documentation complémentaire
Other infos	According to the opportunities and practical availability, the course can be completed by technical visits and / or seminars given by experts from industry
Faculty or entity in charge	ELEC

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Aims
Master [120] in Electrical Engineering	ELEC2M	4		
Master [120] in Chemical and Materials Engineering	KIMA2M	4		