UCLouvain

lelec2895

2021

Design of micro and nanosystems

5.00 credits	30.0 h + 30.0 h	Q1

Teacher(s)	Francis Laurent ;
Language :	English
Place of the course	Louvain-la-Neuve
Main themes	This cursus is part of the MEMS & NEMS, Micro and Nanotechnology ELEC options. LELEC2895 is focused on the understanding and the design of micro-electromechanical devices (MEMS), on transducers (sensors, actuators) made using micro and nanofabrication technologies, to their co-integration with integrated circuits (IC), to their multiphysics simulation and characterisation, to their reliability and their interconnect.
Learning outcomes	**At the end of this learning unit, the student is able to :** With respect to the AA referring system defined for the Master in Electrical Engineering, the course contributes to the develoopment, mastery and assessment of the following skills : • AA1.1, AA1.2, AA1.3 • AA2.1, AA2.2, AA2.3, AA2.4, AA2.5 • AA3.1, AA3.2, AA3.3 • AA4.2, AA4.3, AA4.4 • AA5.1, AA5.2, AA5.3, AA5.4, AA5.5, AA5.6 • AA6.1, AA6.3, AA6.4 1 **After this course, the student will be able to:** • Describe the transduction principles and scaling effects • Understand specifications for a MEMS • Design MEMS and NEMS and use multiphysics simulation softwares and tools • Identify electronic circuits adapted to MEMS and NEMS • Identify fabrication techniques required to make such devices • Analyse the reliability of miniaturised devices • Present (report) and defend (slides) the results of a group project (with 2 to 4 students)
Evaluation methods	The course is subject to continuous evaluation for 3/5 of the final grade during the semester when submitting group work reports on the practical work sessions, and for 2/5 by an individual oral examination in session. The in-session exam is a closed book exam assisted by a written preparation.The group work note is kept for all sessions of the same academic year.
Teaching methods	The course is organised as following • 10 sessions of theoretical lectures, based on flipped classes helped by the resolution in students group of numerous examples and cases • 1 tutorial session related to the software tools • 3 sessions of design practical works, with teaching support • 1 industrial seminar
Content	1. MEMS design methodology 2. Scale effects and transduction principles 3. Sensors and actuators: electrical, mechanical, thermal, optical, (bio)chemical, etc... 4. Fabrication processes 5. Selection of electronic interface circuits 6. Multiphysics simulations
Inline resources	Moodle http://moodleucl.uclouvain.be/course/view.php?id=7527
Bibliography	Supports • Transparents disponibles sur Moodle/Slides available on Moodle • Livre de référence disponible à la Bibliothèque des Sciences et Technologies/Reference book available at the Science and Technology Library (Ville Kaajakari, "Practical MEMS", Small Gear Publishing)

Other infos	LELEC2560 Micro and Nanofabrication Techniques is a desirable prerequisite. Basic knowledge of electronics, solid-state physics, materials science and chemistry is an advantage.
Faculty or entity in charge	ELEC

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Physical Engineering	FYAP2M	5		
Master [120] in Chemical and Materials Engineering	KIMA2M	5		
Master [120] in Electrical Engineering	ELEC2M	5		
Advanced Master in Nanotechnologies	NANO2MC	5		