




Teacher(s)	Francis Laurent ;
Language :	English > French-friendly
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	<p><b>At the end of this learning unit, the student is able to :</b></p> <p>With respect to the AA referring system defined for the Master in Electrical Engineering, the course contributes to the development, mastery and assessment of the following skills :</p> <ul style="list-style-type: none"> <li>• AA1.1, AA1.2, AA1.3</li> <li>• AA2.1, AA2.2, AA2.3, AA2.4, AA2.5</li> <li>• AA3.1, AA3.2, AA3.3</li> <li>• AA4.2, AA4.3, AA4.4</li> <li>• AA5.1, AA5.2, AA5.3, AA5.4, AA5.5, AA5.6</li> <li>• AA6.1, AA6.3, AA6.4</li> </ul> <p>1</p> <p><b>After this course, the student will be able to:</b></p> <ul style="list-style-type: none"> <li>• Describe the transduction principles and scaling effects</li> <li>• Understand specifications for a MEMS</li> <li>• Design MEMS and NEMS and use multiphysics simulation softwares and tools</li> <li>• Identify electronic circuits adapted to MEMS and NEMS</li> <li>• Identify fabrication techniques required to make such devices</li> <li>• Analyse the reliability of miniaturised devices</li> <li>• Present (report) and defend (slides) the results of a group project (with 2 to 4 students)</li> </ul>
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, unless the mark of the individual oral examination is less than 10/20 in which case the final mark will be that of the individual oral examination only. The in-session exam is an open book exam assisted by a written preparation. The group work note is kept for all sessions of the same academic year.
Teaching methods	<p>The course is organised as following</p> <ul style="list-style-type: none"> <li>• 10 sessions of theoretical lectures, based on flipped classes helped by the resolution in students group of numerous examples and cases</li> <li>• 1 tutorial session related to the software tools</li> <li>• 3 sessions of design practical works, with teaching support</li> <li>• 1 industrial seminar</li> </ul>
Content	<ol style="list-style-type: none"> <li>1. MEMS design methodology</li> <li>2. Scale effects and transduction principles</li> <li>3. Sensors and actuators: electrical, mechanical, thermal, optical, (bio)chemical, etc...</li> <li>4. Fabrication processes</li> <li>5. Selection of electronic interface circuits</li> <li>6. Multiphysics simulations</li> </ol>
Inline resources	Moodle <a href="http://moodleucl.uclouvain.be/course/view.php?id=7527">http://moodleucl.uclouvain.be/course/view.php?id=7527</a>
Bibliography	<p><u>Supports</u></p> <ul style="list-style-type: none"> <li>• Transparents disponibles sur Moodle/Slides available on Moodle</li> <li>• 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)</li> </ul>

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

<b>Programmes containing this learning unit (UE)</b>				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Chemical and Materials Engineering	<a href="#">KIMA2M</a>	5		
Master [120] in Electrical Engineering	<a href="#">ELEC2M</a>	5		
Master [120] in Physical Engineering	<a href="#">FYAP2M</a>	5		
Advanced Master in Nanotechnologies	<a href="#">NANO2MC</a>	5		