

Teacher(s)	Oestges Claude (coordinator) ;Vandendorpe Luc ;
Language :	English > French-friendly
Place of the course	Louvain-la-Neuve
Main themes	This course is one of the last courses in the telecommunication cursus. LELEC2796 deals with the PHY layer of wireless communication systems, along three axes : radio channels, signal processing techniques and communication standards.
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, AA2.4</li> <li>• AA3.1</li> <li>• AA4.1, AA4.2, AA4.4</li> <li>• AA5.2, AA5.3, AA5.6</li> <li>• AA6.1, AA6.3</li> </ul> <p><b>At the end of the course, the student will be able to :</b></p> <p>1</p> <ul style="list-style-type: none"> <li>• Define concepts enabling to fully characterize radio channels (narrow- and wideband, as well multi-antenna channels)</li> <li>• Explain through analytical models and Matlab simulations the impact of the propagation channel and co-channel interference on system performance</li> <li>• Describe and compare various multiple access techniques (TDMA/FDMA/CDMA)</li> <li>• Explain, via mathematical representations, and analyze receive techniques (Rake receiver, joint detection, OFDM, SIMO/MISO/MIMO)</li> <li>• Describe the radio interface of wireless communication standards (GSM, UMTS, IS95/UTRA, 3G-LTE), together with the underlying concepts</li> <li>• Present (written report and oral presentation) the results achieved within a group project, consisting in the Matlab implementation of a wireless system in a real-world channel</li> </ul>
Evaluation methods	<p>Regarding the course, the oral (and/or written) evaluation is individual (no book/notes allowed) and based on clearly announced objectives (see above).</p> <p>The evaluation of the project is based on the submission of an oral presentation by the group (and possibly, of a written article-like report); the acquired project grade holds for all sessions (January and August).</p> <p>The final grade is obtained by combining the grades of the exam and the project as follows</p> <ul style="list-style-type: none"> <li>• if the 2 marks are equal to or higher than 7/20, the project is worth 1/3 of the overall mark;</li> <li>• if one of the two marks is strictly less than 7/20, the overall mark is the minimum of the two marks.</li> </ul>
Teaching methods	<p>The course is organized as</p> <ul style="list-style-type: none"> <li>• 13 lectures</li> <li>• 5 to 6 exercise sessions</li> <li>• a 2-3 student group project on network design (python)</li> </ul>
Content	<ul style="list-style-type: none"> <li>• Introduction to wireless communication systems</li> <li>• Random signals, modulations and detection</li> <li>• Mobile transmission channels</li> <li>• Multiple access techniques</li> <li>• CDMA, Rake reception and diversity</li> <li>• UTRA and WCDMA standards</li> <li>• Multi-antenna channels and systems</li> <li>• MIMO and multi-user MIMO techniques</li> <li>• LTE, LTE-A and NR standards</li> </ul> <p>This teaching unit also tackles issues linked to sustainable development and transition through the project, which namely addresses sustainable wireless network design metrics (exposure, energy efficiency, etc.).</p>

Inline resources	<a href="https://moodle.uclouvain.be/course/view.php?id=1465">https://moodle.uclouvain.be/course/view.php?id=1465</a>
Bibliography	<p><u>Supports</u></p> <ul style="list-style-type: none"> <li>• Lecture notes available on Moodle</li> <li>• Slides available on Moodle</li> <li>• Reference books available at BST and on Moodle</li> </ul>
Other infos	It is advized to follow LELEC2796 during Master 2.
Faculty or entity in charge	ELEC

<b>Programmes containing this learning unit (UE)</b>				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Electrical Engineering	ELEC2M	5		