UCLouvain

lelec2796

2023

Wireless communications

5.00 credits	30.0 h + 30.0 h	Q1

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	**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, AA2.4 • AA3.1 • AA4.1, AA4.2, AA4.4 • AA5.2, AA5.3, AA5.6 • AA6.1, AA6.3 **At the end of the course, the student will be able to :** 1 • Define concepts enabling to fully characterize radio channels (narrow- and wideband, as well multi-antenna channels) • Explain through analytical models and Matlab simulations the impact of the propagation channel and co-channel interference on system performance • Describe and compare various multiple access techniques (TDMA/FDMA/CDMA) • Explain, via mathematical representations, and analyze receive techniques (Rake receiver, joint detection, OFDM, SIMO/MISO/MIMO) • Describe the radio interface of wireless communication standards (GSM, UMTS, IS95/UTRA, 3G-LTE), together with the underlying concepts • 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
Evaluation methods	Regarding the course, the oral (and/or written) evaluation is individual (no book/notes allowed) and based on clearly announced objectives (see above). 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). The final grade is obtained by combining the grades of the exam and the project as follows • if the 2 marks are equal to or higher than 7/20, the project is worth 1/3 of the overall mark; • if one of the two marks is strictly less than 7/20, the overall mark is the minimum of the two marks.
Teaching methods	The course is organized as • 13 lectures • 5 to 6 exercise sessions • a 2-3 student group project on network design (python)
Content	• Introduction to wireless communication systems • Random signals, modulations and detection • Mobile transmission channels • Multiple access techniques • CDMA, Rake reception and diversity • UTRA and WCDMA standards • Multi-antenna channels and systems • MIMO and multi-user MIMO techniques • LTE, LTE-A and NR standards 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.).

Inline resources	https://moodle.uclouvain.be/course/view.php?id=1465
Bibliography	Supports • Lecture notes available on Moodle • Slides available on Moodle • Reference books available at BST and on Moodle
Other infos	It is advized to follow LELEC2796 during Master 2.
Faculty or entity in charge	ELEC

Programmes containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Electrical Engineering	ELEC2M	5		