




Teacher(s)	Pelsser Cristel ;
Language :	English > French-friendly
Place of the course	Louvain-la-Neuve
Main themes	<ul style="list-style-type: none"> • Introduction to Verilog (for who did not follow LELEC 2531 students) • Embedded processors and "soft-core" like Nios or MicroBlaze on FPGA • Standard devices of a processor and development of a dedicated device • Adding specialized instructions ("custom instructions") to the processor architecture • Architecture of a dual-core system. Communication between cores • Real-time operating systems: characterization and comparison • In-depth analysis of a real-time OS open-source (eg MicroC-OS/II) • Programming methodology of an application on a real-time OS • Embedded Linux. Development of driver • Implementation of a wireless module connected to the FPGA board
Learning outcomes	<p>At the end of this learning unit, the student is able to :</p> <p>Given the learning outcomes of the "Master in Computer Science and Engineering" program, this course contributes to the development, acquisition and evaluation of the following learning outcomes:</p> <ul style="list-style-type: none"> • INFO1.1-3 • INFO2.2-4 • INFO5.2, INFO5.4-5 • INFO6.3 <p>Given the learning outcomes of the "Master [120] in Computer Science" program, this course contributes to the development, acquisition and evaluation of the following learning outcomes:</p> <p>1</p> <ul style="list-style-type: none"> • SINF1.M1 • SINF2.2-4 • SINF5.2, SINF5.4-5 • SINF6.3 <p>Students completing this course successfully will be able to</p> <ul style="list-style-type: none"> • implement a multi-core system on FPGA using a Nios or MicroBlaze soft-core including peripherals, memories, caches, ... • make an argued choice between RTOS running on a multi-core system • use an RTOS running on a multi-core systems by taking advantage of his strengths • program effectively an application with real-time constraints by implementing a rigorous methodology.
Evaluation methods	<p>The evaluation is based on 3 evaluations: 2 intermediary evaluations and a final evaluation in June. Each intermediary evaluation counts for 1/4 while the final evaluation counts for 2/4.</p> <p>In case of second session, the result obtained during the 2nd session replaces all preceding grades.</p>
Teaching methods	<p>The teaching methodes includes lecture sessions where the main issues are explained. The implementation is done through assignments that students perform individually or in groups.</p> <p>Material will be lent to each student in the course so that she/he can develop a personal expertise.</p>
Content	<ul style="list-style-type: none"> • Embedded processors • Standard peripherals • Multi-core architecture and communication between cores • Real-time operating systems: characterization and comparison • In-depth study of a real-time OS • Programming methods of applications on top of a real-time OS • Embedded Linux • Security of embedded systems • Secure programming with Rust for embedded systems <p>FPGA and Verilog will not be taught this year.</p>

Inline resources	https://moodle.uclouvain.be/course/view.php?id=558
Bibliography	<ul style="list-style-type: none"> • Real-time Operating Systems Book 1 - The Theory Jim Cooling - Lindentree Associates 2017 - ISBN: 9781 5496 0894 0
Other infos	Background: Preliminary knowledge of computer architecture and programming.
Faculty or entity in charge	INFO

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Electrical Engineering	ELEC2M	5		
Master [120] in Computer Science and Engineering	INFO2M	5		
Master [120] in Computer Science	SINF2M	5		
Master [120] in Electro-mechanical Engineering	ELME2M	5		