UCLouvain

lelec2570

2026

Synthesis of digital integrated circuits

5.00 credits	30.0 h + 30.0 h	Q1

Teacher(s)	Bol David ;
Language :	English > French-friendly
Place of the course	Louvain-la-Neuve
Prerequisites	• The basic formation in digital electronic circuits is compulsory: LELEC2531 at UCL. • A course in embedded system design is an advantage: LINGI2315 at UCL. *The prerequisite(s) for this Teaching Unit (Unité d'enseignement – UE) for the programmes/courses that offer this Teaching Unit are specified at the end of this sheet.*
Main themes	The exponential increase in computing performances of digital integrated circuits (ICs) fundamentally modified our everyday's life in numerous domains (consumer, business, medical, industrial). Nowadays these circuits feature several millions of transistors, which results a high design complexity.
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 development, mastery and assessment of the following skills : • AA1.1AA1.2 • AA2.1, AA2.2, AA2.3, AA2.4, AA2.5 • AA3.1 • AA5.5 • AA6.1, AA6.2, AA6.3 b. **After this course, the electrical engineers in circuit and systems should be able to:** • produce the layout of a digital IC in a modern CMOS technology starting from a behavorial description and using industrial-level EDA tools; • discuss the trade-offs linked to the synthesis of digital ICs between silicon area, computing performance, power consumption, flexibility and robustness; • setup a strategy for verifying the obtained results using HDL simulations; • rapidly evaluate the efficiency of high-level architectural solutions and HW/SW optimizations; • communicate clearly and efficiently technical results in a circuit design report; • be able to describe the rebound effect mechanisms in the dominant buisness model of the semiconductor industry.
Evaluation methods	See the French version.
Teaching methods	The course is organized as follows. • Lectures introducing the various digital IC concepts, illustrated by recent digital IC examples from both the industrial and research worlds. • Seminars given by experts from the industrial world regarding the design of digital ICs. • A central project on the full design of an industry-relevant digital SoC with weekly group assignements linked to the steps of the design flow. In this project, the students use industrial EDA tools to design their SoC. • The interaction between the students, the teachers and assistants will be encouraged by the use of a discussion forum on Moodle platform and interactive project debriefing sessions during the lectures. This course adresses questions linked to sustainability and the socio-ecological transition through a 2-hour lecture on the ecological consequences of the microelectronics buisness model.
Content	• Microcontroller-based embedded systems. • High-level design and verification of digital SoCs. • Robust HDL coding in Verilog. • Logic synthesis of digital circuits. • Clocking and timing closure. • Digital standard cell libraries and hard macros. • Place and route of digital circuits. • CMOS technology scaling. • DSP architecture, arithmetic circuits and hardware accelerators. • Historical perspective on the development of the microelectronics industry and its ecological implications.

Inline resources	Moodle https://moodle.uclouvain.be/course/view.php?id=557
Bibliography	Chapitres de certains livres de référence.
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	LELEC2531	🔍
Master [120] in Electro-mechanical Engineering	ELME2M	5		🔍