UCLouvain

lelec2532

2025

Analog electronic systems

5.00 credits	30.0 h + 30.0 h	Q2

Teacher(s)	Bol David ;Flandre Denis (coordinator) ;
Language :	English > French-friendly
Place of the course	Louvain-la-Neuve
Prerequisites	Students are expected to master the following skills: continuous-time signal representation both in time and frequency domains, mathematical system representations (transfer function, impulse response, stability, filtering), principles and properties of Fourier and Laplace transforms, analysis of electrical circuits based on passive components (R, L, C), in DC, transient and AC regimes, understanding of general behavior of operational amplifiers, diodes and transistors with the associated basic electronic circuits, as they are covered within the courses LFSAB1106, LELEC1370 and LELEC1530.
Main themes	The world we live in is getting more and digital with electronic embedded systems surrounding us and communicating with the cloud. However, the physical world is analog in essence. The digital embedded systems thus need analog functions to interact with the physical world, its users, the cloud, the energy sources, as well as between themselves. This is done through sensors, actuators, user interfaces, power management units, wireline and wireless communications. Digital systems also rely on key analog functions performed internally for efficient operation: memories, clocking and voltage regulation. In this course, we study the architecture of the key analog electronic systems performing these functions. Within the ELEC/ELME formation, this course presents analog system architectures as a complementary to ELEC2531 course on digital system architectures. It serves as a basis for the courses on integrated-circuit synthesis (ELEC2650, ELEC2570 and ELEC2620).
Learning outcomes	**At the end of this learning unit, the student is able to :** a. Contribution of the activity to the learning outcomes of the program · AA1 Knowledge base : electronic concepts (AA1.1), simulation and CAD tools (AA1.2-3); · AA2 Engineering skills: problem analysis (AA2.1) and solution comparison (AA2.3), 2.4 and 2.5; · AA3 R&D skills : find appropriate references on the existing solutions in the field of the flipped class topic (AA3.1), 3.2 and 3.3; · AA5 Communication skills: oral communication (AA5.3, AA5.6), 5.4; b. Learning outcomes **After this course, the electrical engineers in circuit and systems should be able to:** · identify the key performance metrics of an analog function in a given application context; · explain the operation of typical analog system architectures; · qualitatively model the performance with respect to the architecture; · evaluate the performance of typical analog system architectures with SPICE simulations.
Evaluation methods	In this course, the students are evaluated through: · a continuous certificative group evaluation of the flipped classes, which includes short summaries of the work sessions in group to be delivered during the semester, weighting 20% of the final grade; · an individual open-book practical written exam at the end of the semester on the flipped-class content and based on SPICE simulations, weighting 30% of the final grade; · an individual written exam during the exam session on the theoretical lectures and practical exercises, weighting 50% of the final grade. The grade of the continuous evaluation is individualized as a function of the implication of the student in the group during the semester of the course (presence at the compulsory activities, active participation to the work, ...). The mark obtained for the continuous evaluation cannot be modified for the second session. The individual exams that are failed need to be retaken in second session. An individual exam that was passed successfully at the first session cannot be retak in the second session and the mark obtained at the first session is conserved for the second session.

Teaching methods	The course is organized as follows: · lectures on generic analog concepts and building blocks, · exercise sessions on these concepts and building blocks, · flipped classes about typical analog applications and associated specific architectures of analog systems, these classes are based on a reading at home and a group challenge in class with a SPICE simulation tool, · seminar given by an expert from the industry (if time allows).
Content	· Noise in analog circuits. · Opamp-based circuits. · Analog filters. · Voltage and current references. · Voltage regulators. · Memories. · CMOS imagers. · Oscillators. · Phase-locked loops (if time allows). · High-speed serial I/Os (if time allows).
Inline resources	https://moodle.uclouvain.be/course/view.php?id=620
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 Biomedical Engineering	GBIO2M	5		
Master [120] in Electrical Engineering	ELEC2M	5		
Master [120] in Electro-mechanical Engineering	ELME2M	5		