Analog electronics

Lecturer
François QUITIN (Coordinator)

Course mnemonic
ELEC-H402

ECTS credits
5 credits

Language(s) of instruction
English

Course period
Second term

Campus
Solbosch

Course content

- Basis of semiconductors physics
- Diode equations
- Bipolar Junction Transistor
- Field-effect transistors (MOSFET and JFET)
- single stage amplifiers with BJT and MOSFET
- differential amplifiers
- complements on the operational amplifier

Objectives (and/or specific learning outcomes)

Specific Competences

To go deeper into knowledge on:

- semiconductor physics
- functioning of components (diodes, transistors)
- basic assemblies based upon those components, mainly discrete amplifiers and opamps

At the end of the course the student will be able to:

- understand the physical bases of the various current semiconductors
- calculate the properties of the basic transistor assemblies on the basis of their equation, their characteristic curves and of their small signal equivalent circuits
- use the simulator SPICE to handle the concepts related to the frequency domain (bandwidth, stability)
- evaluate the importance of the imperfections of the operational amplifiers in order to select an adequate component

Generic competences

- Resolution of technical problem by using the acquired knowledge and with a scientific and rigorous methodology
- Team work
- Technical and interpersonal communication

Teaching method and learning activities

Lectures (24h=12x2h)

Labs (36h=9x4h) in groups of 2 to 3 students

- learn to use the SPICE simulator by analyzing MOSFET amplifier circuits
- learn to use the CAD software to design Printed Circuit Boards,
- solder components on the PCB and test the PCB with lab equipment

Contribution to the teaching profile

This teaching unit contributes to the following competences:

- Abstraire, modéliser et simuler des systèmes physiques complexes rencontrés dans les applications biomédicales (bioélectricité, biomécanique, écoulements, etc.)
- Traiter et analyser des signaux de toute nature, 1D, image, vidéo, en particulier ceux issus des dispositifs médicaux

References, bibliography and recommended reading

- **FLOYD TL**
  "Électronique composants et systèmes d'applications"
  Editions Reynald Goulet
  SEDRA/SMITH
  "Microelectronic Circuits"
  Oxford University Press
  MANCINI R
  "Op-amps for every one"
  www.ti.com/lit/an/slod006b/slod006b.pdf
  CARTER B
  "Handbook of Operational Amplifier Applications"
  www.ti.com/lit/an/sboa092a/sboa092a.pdf

Other information

Place(s) of teaching

Solbosch

Contact(s)

Lecturer: François QUITIN

Assistants: Renaud THEUNISSEN

Evaluation method(s)

Other

Evaluation method(s) (additional information)

The written exam evaluates both the lectures and the labs

- The written exam is "open-book", students can use their notes
- A lab exam is organized to evaluate the lab learnings, i.e. the student will have to use the SPICE software to analyze a circuit. There is no second session mark for the lab exam, i.e. the first session mark of the lab exam will count for the final grade of the course.

Determination of the mark (including the weighting of partial marks)

The grade is split as follows: 1/3 on the lab exam, 2/3 on the written exam. There is no second session mark for the lab exam, i.e. the first session mark of the lab exam will count for the final grade of the course.

Main language(s) of evaluation

English

Programmes

Programmes proposing this course at the Brussels School of Engineering

MA-IRCB | Master of science in Biomedical Engineering | finalité Professional/unit 1