Faculty of Applied Sciences

ELEC1530   Electronics I : Basic amplifiers circuits

[30h+30h exercises] 5 credits

This course is taught in the 2nd semester

Teacher(s):   Jean-Didier Legat, Charles Trullemans
Language: French
Level: First cycle

Aims

The courses Electronics 1, 2 and 3 are the fundamental courses in active electronic circuits, linear or non-linear, analogue or digital. They are seen in the perspective of circuit implementation in integrated technologies (implied from the beginning of the course) or as an assembly of discrete components.
The first course makes use of circuit theory concepts and assumes a basic knowledge in device physics. It is focusing on the analysis of elementary amplifiers circuits.
After this course, the students will be able
- to explain the theoretical concepts allowing the description of the behaviour and of the performances of amplifiers and of basic cells and devices seen as amplifiers components
- to implement the necessary concepts and methods in order to analyse circuits from schematics, from mathematicals modelling and simulations or from laboratory data
- in some cases, to realize design or optimization

Main themes

Identical to the contents of the course

Content and teaching methods

- The external view of an amplifier is a loaded quadripole. The first thing to do is to define and to specify its external characteristics. This introduces simultaneously the basic concepts of circuit analysis and design : equivalent circuit modelling feedback, temporal and frequency response, dominant poles...
- Amplifiers are made of active non-linear devices. Nevertheless, linear circuit analysis techniques can be applied thanks to the use of small signal device models (or more basic concept).
- These devices allow realizing one transistor basic cells. The properties of these cells are described, then basic cells are assembled in more complex ones (current mirror, cascode, differential, push-pull amplifiers). Eventually, a simple but complete operational amplifier is analysed.
- Used in strongly non-linear conditions, an elementary amplifier cell is also a basic cell for digital circuits where an arbitrary large number of operations can be applied to a signal. The physical principles of electronic memories can also be explained in this case.

Other information (prerequisite, evaluation (assessment methods), course materials recommended readings, ...)

Teaching and learning methods
Lectures, exercices, laboratory experiments
An in-depth understanding of the complex behaviour of devices and circuits is based of a mixed strategy of systematic analysis and of intuition, of educated guess and of evaluation. In this context, bookish knowledge is not enough. Accumulated personal problem solving experience is mandatory
Prerequisites
ELEC1101, ELEC1370, and ELEC1330 or ELEC1755 courses
Assessment
Oral and written examination. The acquired knowledge, but mainly the ease demonstrated when applying concepts and methods are of uttermost importance.

Other credits in programs

ELEC22	Deuxième année du programme conduisant au grade d'ingénieur civil électricien	(5 credits)
ELME22/M	Deuxième année du programme conduisant au grade d'ingénieur civil électro-mécanicien (mécatronique)	(5 credits)
FSA13BA	Troisième année de bachelier en sciences de l'ingénieur, orientation ingénieur civil	(5 credits)
MAP22	Deuxième année du programme conduisant au grade d'ingénieur civil en mathématiques appliquées	(5 credits)