Last update: 05-07-2019

230014 - FISE - Electronic Functions and Systems

Coordinating unit: 230 - ETSETB - Barcelona School of Telecommunications Engineering
Teaching unit: 710 - EEL - Department of Electronic Engineering
Academic year: 2019
Degree: BACHELOR'S DEGREE IN NETWORK ENGINEERING (Syllabus 2010). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN TELECOMMUNICATIONS SYSTEMS ENGINEERING (Syllabus 2010). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN TELECOMMUNICATIONS SCIENCE AND TECHNOLOGY (Syllabus 2010). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN ELECTRONIC SYSTEMS ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN AUDIOVISUAL SYSTEMS ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Teaching unit Compulsory)
ECTS credits: 6 Teaching languages: Catalan, Spanish

Teaching staff

Coordinator: Turo Peroy, Antonio
Chavez Dominguez, Juan Antonio

Others: Garcia Gonzalez, Miquel Angel
Lopez Gonzalez, Juan Miguel
Orpella Garcia, Alberto
Ortega Villasclaras, Pablo Rafael
Pol Fernandez, Clemente

Prior skills

- Circuit analysis.
- Passive components: resistor, capacitor and inductor.
- Active components: diodes and transistors.
- Basic laboratory instruments: oscilloscope, multimeter, function generator and power supply.

Requirements

LINEAR CIRCUITS - Prerequisite

Degree competences to which the subject contributes

Generical:

2. ABILITY TO IDENTIFY, FORMULATE AND SOLVE ENGINEERING PROBLEMS Level 1.To identify the complexity of the problems presented in the subjects. To set out correctly the problem correctly from the statements suggested. To identify the possible options for its resolution. To choose an option, apply it and to identify the need to change it in case of fail. To provide tools and methods to test whether the solution is correct or at least consistent. To identify the role of creativity in science and technology
3. They will have acquired knowledge related to experiments and laboratory instruments and will be competent in a laboratory environment in the ICC field. They will know how to use the instruments and tools of telecommunications and electronic engineering and how to interpret manuals and specifications. They will be able to evaluate the errors and limitations associated with simulation measures and results.

Transversal:

1. EFFECTIVE USE OF INFORMATI0N RESOURCES - Level 2. Designing and executing a good strategy for advanced searches using specialized information resources, once the various parts of an academic document have been identified and bibliographical references provided. Choosing suitable information based on its relevance and quality.

Teaching methodology

Lectures
Application classes
Laboratory activities
Individual work
Exercises
Short answer test (Control)
Extended answer test (Final Exam)

Learning objectives of the subject

The first learning objevive of the course is the study of the electronic circuits to implement the basic analog functions such as linear and nonlinear applications and signal generation by using operational amplifiers, AD and DA converters, and other linear integrated circuits. The feedback theory is introduced as a design tool with a view to this purpose.

The second learning objective is to introduce the systems for the generation and distribution of electric energy paying special attention to photovoltaic solar energy and to the AC/DC, DC/AC and DC/DC conversions.

Learning results:

- To analyse and design the electronic circuits implemented with linear integrated circuits that perform the basic analog functions.

- To understand the use of the different energy sources, especially the photovoltaic solar energy and the power electronics fundamentals.

- To design a good strategy for an advanced information search using specialized resources and to identify the relevance and quality of this information.

Laboratory learning results:

- To become skilful with the tools, instruments and software available at the laboratories and to understand their operation and limitations.

- To use properly the simulation software for the simulation of electronic circuits and power supply systems.

- To implement, measure and verify the electronic circuits explained in the course.

Study load

Total learning time: 150h	Hours large group:	39h	26.00%
	Hours small group:	26h	17.33%
	Self study:	85h	56.67%

Content

Part 1. Amplification: Limitations of the operational amplifier and other integrated amplifiers	Learning time: 15h Theory classes: 6h Self study : 9h

Description:
Op amp powering. Dynamic ranges. Input output transfer characteristics, operating ranges and equivalent models. input and output impedances. Polarization currents. Offset voltage errors. Common mode rejection ratio. Frequency response. Slew-rate.

Part 2. Feedback techniques in electronic circuits	Learning time: 25h Theory classes: 10h Self study : 15h

Description:
Feedback fundamentals. Equations and modelling of circuits with a feedback loop. Advantages and drawbacks of feedback systems. Stability. Application to the frequency compensation of amplifiers and to the design of sinusoidal signal generators.

Part 3. Applications with integrated circuits	Learning time: 33h Theory classes: 13h Self study : 20h

Description:
Electronic circuits with operational amplifiers for the implementation of linear and non linear applications and signal generators. A/D and D/A converters are also included.

Part 4. Power Supply Systems	Learning time: 25h Theory classes: 10h Self study : 15h

Description:
Generation and distribution of electrical energy. Power electronics fundamentals. AC/DC, DC/AC, DC/DC conversions. Linerar and switched mode voltage regulators. Architecture, blocks and sizing of power supply systems. Application to stand-alone and grid-connected renewable energy systems with special attention to photovoltaic solar systems.

Laboratory activities	Learning time: 52h Laboratory classes: 26h Self study : 26h
Description: Lab 0: Introductory session to PSPICE simulator Lab 1: PSPICE simulation of electronic circuits based on operational amplifiers (2 sessions) Lab 2: Design, implementation and characterization of a two-stage amplifier based on op amps (2 sessions) Lab 3: Simulation and experimental verification of a filter and an oscillator (2 sessions) Lab 4: Distance measurement by means of ultrasund (3 sessions) Lab 5: Sizing of stand-alone photovoltaic systems (2 sessions)	

Qualification system

Laboratory activities (LAB): 20%
Laboratory final exam (EXLAB): 20%

Theory midterm exam (EXPAR): 20%
Theory final exam (EXFIN): 40%

Final grade (NF) is the major of the two following expressions:
NF = 0,2*LAB + 0,2*EXLAB + 0,2*EXPAR + 0,4*EXFIN ,   or
NF = 0,2*LAB + 0,2*EXLAB + 0,6*EXFIN , in case the result of this expression is greater than the previous one.

The reassessment only includes the theory exam of the course. Grades of the laboratoy part will be maintained from the previous assessment.

Bibliography

Basic:

Franco, S. Diseño con amplificadores operacionales y circuitos integrados analógicos. México: McGraw-Hill, 2005. ISBN 9701045955.

Castañer Muñoz, L.; Silvestre Berges, S. Modelling photovoltaic systems: using PSpice. Chichester: John Wiley & Sons, 2002. ISBN 0470845287.

Complementary:

Floyd, T.L.; Buchla, D. Fundamentals of analog circuits. 2nd ed. Upper Saddle River, N.J.: Prentice Hall International, 2002. ISBN 9780130606198.