Course guide
230014 - FISE - Electronic Functions and Systems

Last modified: 11/04/2025

Unit in charge:	Barcelona School of Telecommunications Engineering
Teaching unit:	710 - EEL - Department of Electronic Engineering.

Degree:	BACHELOR'S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Compulsory subject).

Academic year: 2025 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer:	ANTONIO TURO PEROY
Others:	Primer quadrimestre: KRISTEL MICHELLE CEDEÑO MATA - 14 ANTONIO TURO PEROY - 11, 12, 13, 14

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.

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

Type	Hours	Percentage
Self study	85,0	56.67
Hours large group	39,0	26.00
Hours small group	26,0	17.33

Total learning time: 150 h

CONTENTS

Part 1. Amplification: Limitations of the operational amplifier and other integrated amplifiers

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.

Full-or-part-time: 15h
Theory classes: 6h
Self study : 9h

Part 2. Feedback techniques in electronic circuits

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.

Full-or-part-time: 25h
Theory classes: 10h
Self study : 15h

Part 3. Applications with integrated circuits

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.

Full-or-part-time: 33h
Theory classes: 13h
Self study : 20h

Part 4. Power Supply Systems

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.

Full-or-part-time: 25h
Theory classes: 10h
Self study : 15h

Laboratory activities

Description:
Lab 1: Analog signal measurements (2 hours)
Lab 2: Introductory session to PSPICE simulator (2 hours)
Lab 3: Real operational amplifier. PSPICE simulation (4 hours)
Lab 4: Design, implementation and characterization of a two-stage amplifier based on op amps (4 hours)
Lab 5: Simulation and experimental verification of a filter and an oscillator (4 hours)
Lab 6: Distance measurement by means of ultrasound (6 hours)
Lab 7: Sizing of stand-alone photovoltaic systems (4 hours)

Full-or-part-time: 52h
Laboratory classes: 26h
Self study : 26h

GRADING 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.