Course guide
320105 - ELOAN - Analogue Electronics

Last modified: 19/04/2023

Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 710 - EEL - Department of Electronic Engineering.

Degree: BACHELOR'S DEGREE IN AUDIOVISUAL SYSTEMS ENGINEERING (Syllabus 2009). (Compulsory subject).

Academic year: 2023 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: José Antonio Soria Pérez

Others: José Antonio Soria Pérez

PRIOR SKILLS

Having completed the subject of Electronic Devices and Circuits(Code: 320100), Fourier Analysis and Differential Equations (Code: 320097)

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CE15-ESAUD. Knowledge and application of the fundamentals of hardware description languages. (Common module for the telecommunications branch)
CE16-ESAUD. Ability to use different energy sources, especially photovoltaic and thermal solar, as well as the fundamentals of electrotechnics and power electronics. (Common Module in the Telecommunications Branch)

TEACHING METHODOLOGY

Analog Electronics is a "project-based-learning" (PBL) course combining the study of electronic circuits in the AC domain of electric signals and audio applications. The lectures cover both the resolution of exercises and / or numerical problems to consolidate the most relevant theoretical concepts and the design of basic audio applications. As for the lab, small electronic prototypes are developed to understand the operation of circuits in the AC domain and verify the operation of different analog systems within the audio applications.

LEARNING OBJECTIVES OF THE SUBJECT

On completing the subject, students will be able to do the following:
- To analyze and design analog circuits in the AC domein of signals and the basic operation principle of audio aplications.
- Understand the performance and aplications based on Operational Amplifiers.
- Learn to use simulation tools for analysing and designing these kind of circuits.
- Make laboratory measurements of the characteristics of analog electronic systems.

STUDY LOAD

Type	Hours	Percentage
Self study	90,0	60.00
Hours large group	30,0	20.00
Hours small group	30,0	20.00

Total learning time: 150 h

CONTENTS

TOPIC 1: Circuits operating in AC domain

Description:
1.1 Circuit analysis using the Laplace transform
1.2 Transient and permanent regimes
1.3 Transfer functions
1.4 Bode diagrams

Related activities:
Problem-based lectures
Activity 1. Problem-solving
Activity 2. Laboratory simulation
Activity 4. Mid-semester test 1

Full-or-part-time: 46h
Theory classes: 8h
Laboratory classes: 8h
Self study : 30h

TOPIC 2: Basics of the Operational Amplifier

Description:
2.1 Operational amplifier (OPAMP)
2.2 Basic amplifiers based on OPAMP
2.3 Summing and subtracting amplifiers (differential)
2.4 OPAMP as comparator
2.5 I-V and V-I current amplifiers and converters
2.6 Features and drawbacks of the real OPAMP

Related activities:
Problem-based lectures
Activity 1. Problem-solving
Activity 2. Laboratory simulation and measurement
Activity 4. Mid-semester test 1

Full-or-part-time: 46h
Theory classes: 8h
Laboratory classes: 8h
Self study : 30h

TOPIC 3: Active Filter and Application Design

Description:
3.1 Passive first- and second-order filters
3.2 Active first-order filters. Integrating and derivative filters
3.3 Low-pass second-order and higher filters
3.4 Band-pass filters
3.5 State-variable filters
3.5 Analog-to-Digital (A/D) and Digital-to-Analog (D/A) Converters

Related activities:
Problem-based lectures
Activity 1. Problem-solving
Activity 2. Laboratory simulation and measurement

Full-or-part-time: 58h
Theory classes: 10h
Laboratory classes: 10h
Self study : 38h

GRADING SYSTEM

The grading of the subject (NF_COURSE) is calculated as:

NF_COURSE = 0,1·Test_NP1 + 0,1·PB_NP1 + 0.1·Test_NP2 + 0,2·PB_NP2 + 0,1·LAB1 + 0,2·LAB2 + 0,2·PRJ (1)

For those students with an unfavorable evaluation (NF_COURSE
NF = 5.0 if NF_REV = 0,5·REV + 0,1·LAB1 + 0,2·LAB2 + 0,2·PRJ >= 5.0 or NF= max(NF_CURSO;NF_REV) otherwise.

EXAMINATION RULES.

- All written exams have a maximum score of 10 points.
- Carrying out all lab activities and the project (LAB1, LAB2 and PRJ included) is necessary for grading the course, or otherwise only written exams are taken into account in (1) and the maximum grade possible is (NF_COURSE - A document with formulae used during course must be downloaded from ATENEA and printed for written acts (NP1, NP2 and EF).
- A scientific calculator can be used during the exams but all kind of devices with communication and Internet connection capabilities are strictly forbidden.

BIBLIOGRAPHY

Basic:
- Fiore, James M. Amplificadores operacionales y circuitos integrados lineales: teoría y aplicación. Madrid: Thomson Paraninfo, 2002. ISBN 8497320999.
- Tomasi, Wayne. Sistemas de comunicaciones electrónicas [on line]. 4ª ed. México D.F: Pearson Educación, 2003 [Consultation: 03/10/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=3801. ISBN 9702603161.
- Simpson, Chester. Linear and switching voltage regulator fundamentals [on line]. Santa Clara, CA: National Semiconductor, 201? [Consultation: 14/05/2020]. Available on: http://www.ti.com/lit/an/snva558/snva558.pdf.
- Abella, Miguel Alonso. Sistemas fotovoltaicos: introducción al diseño y dimensionado de instalaciones de energía solar fotovoltaicas. 2ª edición. Madrid: Publicaciones Técnicas, 2005. ISBN 978-84-86913-12-0.

Complementary:
- Rashid, Muhammad H. Circuitos microelectrónicos: análisis y diseño. Madrid: International Thomson, 2002. ISBN 8497320573.

- Luque, A.; Hegedus, S. (eds.). Handbook of photovoltaic science and engineering [on line]. 2nd ed. Chichester: John Wiley & Sons, 2011 [Consultation: 19/09/2022]. Available on: https://onlinelibrary-wiley-com.recursos.biblioteca.upc.edu/doi/book/10.1002/9780470974704. ISBN 9780470974704.
- Mohan, Ned; Undeland, Tore M.; Robbins, William P. Power electronics: converters, applications and design. 2nd edition. New York: John Wiley & Sons, 1995. ISBN 978-04-71226-93-2.