320105 - ELOAN - Analogue Electronics

Coordinating unit: 205 - ESEIAAT - Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 710 - EEL - Department of Electronic Engineering
Academic year: 2018
Degree: BACHELOR'S DEGREE IN AUDIOVISUAL SYSTEMS ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
ECTS credits: 6
Teaching languages: Catalan, Spanish

Teaching staff
Coordinator: José Antonio Soria Pérez
Others: José Antonio Soria Pérez

Opening hours
Timetable: The office hour schedule for students is programmed at the beginning of the course

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:
CE04. AUD_BASIC: Ability to understand and have a full command of the basic concepts of linear systems and related functions and transforms, theory of electrical circuits, electronic circuits, physical principle of semiconductors and logic families, electronic and photonic devices, materials technology and how they can be applied to the problems inherent to engineering.

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 domain of signals and the basic operation principle of audio applications.
- Understand the performance and applications 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

<table>
<thead>
<tr>
<th></th>
<th>Hours large group:</th>
<th>30h</th>
<th>20.00%</th>
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<tbody>
<tr>
<td>Total learning time:</td>
<td></td>
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<tr>
<td>Hours medium group:</td>
<td>0h</td>
<td>0h</td>
<td>0.00%</td>
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<tr>
<td>Hours small group:</td>
<td>30h</td>
<td>30h</td>
<td>20.00%</td>
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<tr>
<td>Guided activities:</td>
<td>6h</td>
<td>6h</td>
<td>4.00%</td>
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<tr>
<td>Self study:</td>
<td>84h</td>
<td>84h</td>
<td>56.00%</td>
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## Content

### TOPIC 1: Circuits operating in AC domain

**Learning time:** 46h  
Theory classes: 8h  
Laboratory classes: 8h  
Self study: 30h

**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

### TOPIC 2: Basics of the Operational Amplifier

**Learning time:** 46h  
Theory classes: 8h  
Laboratory classes: 8h  
Self study: 30h

**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
### TOPIC 3: Active Filter and Application Design

**Learning time:** 58h  
- Theory classes: 10h  
- Laboratory classes: 10h  
- Self study: 38h

**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

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### Qualification system

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

\[
NF_{\text{COURSE}} = 0.1 \cdot \text{Test\_NP1} + 0.1 \cdot \text{PB\_NP1} + 0.1 \cdot \text{Test\_NP2} + 0.2 \cdot \text{PB\_NP2} + 0.1 \cdot \text{LAB1} + 0.2 \cdot \text{LAB2} + 0.2 \cdot \text{PRJ}
\]  

(1)

For those students with an unfavorable evaluation (NF_COURSE < 5.0) but meeting the requirements of reevaluation, the reevaluation exam (REV) updates only the marks corresponding to the in-site written acts (TEST_NP1, PB_NP1, TEST_NP2 and PB_NP2) and keep the marks corresponding to works, projects and lab activities (LAB1, LAB2 and PRJ) intact. In this case, the grading is calculated as:

\[
NF = 5.0 \text{ if } NF_{\text{REV}} = 0.5 \cdot \text{REV} + 0.1 \cdot \text{LAB1} + 0.2 \cdot \text{LAB2} + 0.2 \cdot \text{PRJ} \geq 5.0 \text{ or } NF = \max(NF_{\text{CURSO}}, NF_{\text{REV}}) \text{ otherwise.}
\]

### Regulations for carrying out activities

- 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 < 5).  
- 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:


Complementary:

