320100 - CDE - Electronic Devices and Circuits

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
LUIS JORGE FERRER ARNAU

Opening hours

Timetable: - José Antonio Soria Pérez: (Time schedule of the office hours is supplied at the beginning of the course)

Prior skills

Average skills and fluent use of Linear Algebra and Infinitesimal Calculus

Degree competences to which the subject contributes

Specific:
1. 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.

Transversal:
2. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.

Teaching methodology

The course is divided into two main parts: one in which technical and analytical training is acquired to understand electrical circuits, and another based on applications where, in addition to knowing the fundamentals of electronic components, real applications of electronics in the industry are seen. The first part includes the solving of exercises (individual and / or group) dedicated to the theoretical aspects of electric networks and usage of the lab instruments. In the second part two basic applications are studied: power supplies and signal amplifiers which are considered two of the first basic circuits of electronic systems in the field of audio and video.

In the lab, basic electronic prototypes are assembled to learn using the instruments in order to perform measurements at a basic level and verify the operation of circuits. These activities are carried out by groups of two students.

Learning objectives of the subject

- Knowing how to use the laws and theorems in order to solve electric circuits with linear components (I/V sources and others: ...
resistors).
- Knowing the behavior of basic electronic devices: Resistors, Capacitors and Inductors, Transformers, Diodes, Transistors (BJT and MOSFET), Voltage Regulators and Operational Amplifiers.
- Reverse Engineering: Knowing how to obtain the behavior of basic real electronic applications.
- Using simulation software to contrast theoretical and experimental data and results.
- Knowing how to read the specifications of electronic components to obtain their limitations
- Use the basic tools and instruments of the lab.
- Developing electronic design in printed boards (PCB) using CAD software.
- Mounting prototypes in test boards (Breadboard)
- Using the lab instruments correctly to develop electric measurements in order to verify the performance of prototypes (power supply, waveform function generator, oscilloscope and multimeter)

<table>
<thead>
<tr>
<th>Study load</th>
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<tbody>
<tr>
<td><strong>Total learning time</strong>: 150h</td>
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<tr>
<td>Hours large group:</td>
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<tr>
<td>Hours medium group:</td>
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<tr>
<td>Hours small group:</td>
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<tr>
<td>Guided activities:</td>
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<tr>
<td>Self study:</td>
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### Content

#### Topic 1: DC CIRCUIT ANALYSIS

- **Description:**
  1.1 Introduction: Representation of circuit diagrams, components, source signals, electric variables and magnitudes.
  1.2 Ohm’s and Kirchoff’s laws (KCL, KVL).
  1.3 Series and Parallel association of resistors. Voltage/Current divider.
  1.4 Thévenin and Norton theorems. Changes of topology.
  1.5 Nodal, branch and mesh analysis.
  1.6 Superposition theorem.
  1.7 Concept of mobility in sources and superfluous component.

- **Related activities:**
  - Test_NP1 - First Test
  - PB_NP1 - Problem solving
  - LAB1 - Lab activities
  - LAB2 - Lab exam

- **Specific objectives:**
  - Basic Training of circuit analysis (Level I)
  - Circuit Simulation
  - Correct use of the DC power supply and the multimeter.
  - Basic electronic prototyping (Level I)

#### Learning time: 71h
- Theory classes: 18h
- Practical classes: 0h
- Laboratory classes: 6h
- Self study: 47h
### TOPIC 2: DC POWER SUPPLY

<table>
<thead>
<tr>
<th>Description:</th>
<th>Learning time: 41h</th>
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<tbody>
<tr>
<td>2.1 DC and AC diode circuit analysis with rectifier and zener diodes (Level II - Intermediate)</td>
<td>Theory classes: 13h 30m</td>
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<tr>
<td>2.2 DC analysis with capacitor and inductor circuits (Level II - Intermediate)</td>
<td>Practical classes: 0h</td>
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<tr>
<td>2.3 Transformers.</td>
<td>Laboratory classes: 4h</td>
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<tr>
<td>2.4 Bridge Rectifiers.</td>
<td>Self study: 23h 30m</td>
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<td>2.5 Voltage Filters</td>
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<td>2.6 Voltage Regulators</td>
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**Related activities:**
- Test NP2 - Second Test
- PB NP2 - Design problem
- LAB1 - Lab activities
- LAB2 - Lab exam

**Specific objectives:**
- Training in Circuit Analysis (Level II - Intermediate)
- Design and Simulation of DC Power Supplies
- Using the oscilloscope correctly
- Electronic prototyping (Level II - Intermediate)
The grading of the subject (NF_COURSE) is calculated as:

\[
NF_{\text{COURSE}} = 0.1 \cdot \text{Test\_NP1} + 0.2 \cdot \text{PB\_NP1} + 0.1 \cdot \text{Test\_NP2} + 0.1 \cdot \text{PB\_NP2} + 0.15 \cdot \text{LAB1} + 0.2 \cdot \text{LAB2} + 0.15 \cdot \text{PRJ}
\]  

(1)

For those students with an unfavorable evaluation (NF_COURSE < 5.0) but meeting the requirements of revaluation, the revaluation exam (REV) updates only the marks corresponding to the in-site written acts (TEST\_NP1, PB\_NP1, TEST\_NP2 and PB\_NP2). The marks corresponding to works, projects and lab activities (LAB1, LAB2 and PRJ) are kept intact. In this case, the grading is calculated as follows

\[
NF = 5.0 \text{ if } NF_{\text{REV}} = 0.5 \cdot \text{REV} + 0.15 \cdot \text{LAB1} + 0.2 \cdot \text{LAB2} + 0.15 \cdot \text{PRJ} > 5.0 \text{ or } NF = \max(NF_{\text{COURSE}}, NF_{\text{REV}})
\]  

otherwise.

**Qualification system**

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

\[
NF_{\text{COURSE}} = 0.1 \cdot \text{Test\_NP1} + 0.2 \cdot \text{PB\_NP1} + 0.1 \cdot \text{Test\_NP2} + 0.1 \cdot \text{PB\_NP2} + 0.15 \cdot \text{LAB1} + 0.2 \cdot \text{LAB2} + 0.15 \cdot \text{PRJ}
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(1)

For those students with an unfavorable evaluation (NF_COURSE < 5.0) but meeting the requirements of revaluation, the revaluation exam (REV) updates only the marks corresponding to the in-site written acts (TEST\_NP1, PB\_NP1, TEST\_NP2 and PB\_NP2). The marks corresponding to works, projects and lab activities (LAB1, LAB2 and PRJ) are kept intact. In this case, the grading is calculated as follows

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NF = 5.0 \text{ if } NF_{\text{REV}} = 0.5 \cdot \text{REV} + 0.15 \cdot \text{LAB1} + 0.2 \cdot \text{LAB2} + 0.15 \cdot \text{PRJ} > 5.0 \text{ or } NF = \max(NF_{\text{COURSE}}, NF_{\text{REV}})
\]  

otherwise.

**Regulations for carrying out activities**

- All activities have a maximum score of 10 points.
- Carrying out all lab activities and the project (LAB1, LAB2 and PRJ included) are 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 exams (TEST\_NP1, TEST\_NP2, PB\_NP1, PB\_NP2).
- A scientific calculator can be used during the exams but all kind of devices with communication and Internet connection capabilities are strictly forbidden.
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Bibliography

Basic:


Complementary:


Others resources: