320100 - CDE - Electronic Devices and Circuits

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
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)

### Study load

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group: 30h</th>
<th>20.00%</th>
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<tbody>
<tr>
<td></td>
<td>Hours medium group: 15h</td>
<td>10.00%</td>
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<tr>
<td></td>
<td>Hours small group: 15h</td>
<td>10.00%</td>
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<tr>
<td></td>
<td>Guided activities: 0h</td>
<td>0.00%</td>
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<tr>
<td></td>
<td>Self study: 90h</td>
<td>60.00%</td>
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</table>
# Content

<table>
<thead>
<tr>
<th><strong>Topic 1: DC CIRCUIT ANALYSIS</strong></th>
<th><strong>Learning time:</strong> 71h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 18h</td>
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<tr>
<td></td>
<td>Practical classes: 0h</td>
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<tr>
<td></td>
<td>Laboratory classes: 6h</td>
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<tr>
<td></td>
<td>Self study: 47h</td>
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## 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 Thevenin and Norton theorems. Changes of topology
1.5. Nodal, branch and mesh analysis.
1.6 Superposition theorem
1.7. Concepto of mobility in sources and superfluous component.

## Related activities:
- Test NP1 - First Test
- PB NP1 - Problem solving
- LAB1 - Lab activities
- LAB 2 - 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)
### TOPIC 2: DC POWER SUPPLY

<table>
<thead>
<tr>
<th>Learning time:</th>
<th>41h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes:</td>
<td>13h 30m</td>
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<tr>
<td>Practical classes:</td>
<td>0h</td>
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<tr>
<td>Laboratory classes:</td>
<td>4h</td>
</tr>
<tr>
<td>Self study:</td>
<td>23h 30m</td>
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</tbody>
</table>

#### Description:
- 2.1 DC and AC diode circuit analysis with rectifier and zener diodes (Level II - Intermediate)
- 2.2 DC analysis with capacitor and inductor circuits (Level II - Intermediate)
- 2.3 Transformers.
- 2.4 Bridge Rectifiers.
- 2.5 Voltage Filters
- 2.6 Voltage Regulators

#### 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)
### Topic 3: AC SIGNAL AMPLIFIERS

<table>
<thead>
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<th>Learning time: 38h</th>
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<tbody>
<tr>
<td>Theory classes: 10h 30m</td>
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<tr>
<td>Practical classes: 0h</td>
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<tr>
<td>Laboratory classes: 4h</td>
</tr>
<tr>
<td>Self study: 23h 30m</td>
</tr>
</tbody>
</table>

#### Description:
- 3.1 Circuit analysis with transistors (BJT and MOSFET) (Nivell III - Advanced).
- 3.2 Biasing of a Signal Amplifier.
- 3.3 Concept of Input/Output Impedance.
- 3.4 Concept of Gain, linearity and Dynamic Range.
- 3.5 Análisis de circuitos con OPAMP (Nivell I - Aplicaciones Básicas)

#### Related activities:
- Test_NP2 - Second Test
- PB_NP2 - Design problem
- LAB1 - Lab activities
- LAB2 - Lab exam

#### Specific objectives:
- Training of circuit analysis (Level III - Advanced)
- Design and Simulation of Signal Amplifiers
- Electronic prototyping with BJT and OPAMPS (level II - Intermediate)

#### Qualification system

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

\[
NF_{\text{COURSE}} = 0.1 \cdot \text{Test}_{\text{NP1}} + 0.2 \cdot \text{PB}_{\text{NP1}} + 0.1 \cdot \text{Test}_{\text{NP2}} + 0.1 \cdot \text{PB}_{\text{NP2}} + 0.15 \cdot \text{LAB1} + 0.2 \cdot \text{LAB2} + 0.15 \cdot \text{PRJ}
\]  

(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

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

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.
Bibliography

Basic:


Complementary:


Others resources: