230014 - FISE - Electronic Functions and Systems

Coordinating unit: 230 - ETSETB - Barcelona School of Telecommunications Engineering
Teaching unit: 710 - EEL - Department of Electronic Engineering
Academic year: 2017
Degree: BACHELOR'S DEGREE IN AUDIOVISUAL SYSTEMS ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN ELECTRONIC SYSTEMS ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN TELECOMMUNICATIONS SYSTEMS ENGINEERING (Syllabus 2010). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN NETWORK ENGINEERING (Syllabus 2010). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN TELECOMMUNICATIONS SCIENCE AND TECHNOLOGY (Syllabus 2010). (Teaching unit Compulsory)
ECTS credits: 6  
Teaching languages: Catalan, Spanish

Teaching staff
Coordinator: Vidal Lopez, Eva Maria
Silvestre Berges, Santiago
Others: Chavez Dominguez, Juan Antonio
Garcies Salva, Pau
Lopez Gonzalez, Juan Miguel
Orpella Garcia, Alberto
Ortega Villasclaras, Pablo Rafael
Pol Fernandez, Clemente
Turo Peroy, Antonio

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.

Requirements
LINEAR CIRCUITS - Prerequisite

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
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The first learning objective 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

<table>
<thead>
<tr>
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<th>Total learning time: 150h</th>
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<tbody>
<tr>
<td></td>
<td>Hours large group:</td>
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<td>Hours small group:</td>
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<tr>
<td></td>
<td>Self study:</td>
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<td>39h</td>
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<td>26h</td>
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<td>85h</td>
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## Content

<table>
<thead>
<tr>
<th>Part 1. Amplification: Limitations of the operational amplifier and other integrated amplifiers</th>
<th>Learning time: 15h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 6h</td>
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<td>Self study: 9h</td>
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**Description:**

<table>
<thead>
<tr>
<th>Part 2. Feedback techniques in electronic circuits</th>
<th>Learning time: 25h</th>
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<tbody>
<tr>
<td></td>
<td>Theory classes: 10h</td>
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<tr>
<td></td>
<td>Self study: 15h</td>
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**Description:**

<table>
<thead>
<tr>
<th>Part 3. Applications with integrated circuits</th>
<th>Learning time: 33h</th>
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<tr>
<td></td>
<td>Theory classes: 13h</td>
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<td>Self study: 20h</td>
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**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.

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<tr>
<td></td>
<td>Theory classes: 10h</td>
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<tr>
<td></td>
<td>Self study: 15h</td>
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</tbody>
</table>

**Description:**
Generation and distribution of electrical energy. Power electronics fundamentals. AC/DC, DC/AC, DC/DC conversions. Linear 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.
Laboratory activities

Description:
Lab 0: Introductory session to PSPICE simulator
Lab 1: PSPICE simulation of electronic circuits based on operational amplifiers (2 sessions)
Lab 2: Design, implementation and characterization of a two-stage amplifier based on op amps (2 sessions)
Lab 3: Simulation and experimental verification of a filter and an oscillator (2 sessions)
Lab 4: Distance measurement by means of ultrasound (3 sessions)
Lab 5: Sizing of stand-alone photovoltaic systems (2 sessions)

Learning time: 52h
Laboratory classes: 26h
Self study: 26h

Qualification 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 laboratory part will be maintained from the previous assessment.

Bibliography

Basic: