Course guides
820756 - ELA - Advanced Electrical Engineering

Unit in charge: Barcelona School of Industrial Engineering
Teaching unit: 709 - DEE - Department of Electrical Engineering.
Degree: MASTER'S DEGREE IN ENERGY ENGINEERING (Syllabus 2013). (Optional subject).
Academic year: 2020  ECTS Credits: 5.0  Languages: English

LECTURER

Coordinating lecturer: Prieto Araujo, Eduardo
Others: Prieto Araujo, Eduardo
Gomis Bellmunt, Oriol

PRIOR SKILLS

Previous knowledge in Circuit Theory and Electrical Engineering

REQUIREMENTS

No prerequisites

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Transversal:
CT4. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.

TEACHING METHODOLOGY

The course development includes the following teaching methods:
- Master class (EXP): theory exposition and Slides-based lecturing.
- Oriented individual works (TD): individual works of reduced complexity or extensión. The acquired knowledge will be applied in these works, and the results will be presented. Their elaboration will start in the classroom (with the teacher guidance) and will end out of the classroom.
- Evaluation activities (EV). Some problems will be proposed as assignment.

In parallel, the students will have to follow the non-contact part of the course (readings and exercises).
During the semester the students will work, in teams of 3 or 4 people, on a tutored project about a specific energy topic, and will write a technical report (or a general scope article, depending on the subject) on that topic, that will defend before their tutor.

LEARNING OBJECTIVES OF THE SUBJECT

Provide students advanced tools and techniques in the field of electrical engineering.
STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guided activities</td>
<td>15,0</td>
<td>11.54</td>
</tr>
<tr>
<td>Self study</td>
<td>85,0</td>
<td>65.38</td>
</tr>
<tr>
<td>Hours small group</td>
<td>30,0</td>
<td>23.08</td>
</tr>
</tbody>
</table>

Total learning time: 130 h

CONTENTS

Transient analysis of electrical circuits

Description:
This content will provide students the necessary tools to work with circuit differential equations

Specific objectives:
- State space equations of electrical circuits.
- Transfer functions of electrical circuits.

Related activities:
A1. - Simulation with Simulink of the transient response of a power converter

Full-or-part-time: 44h
Laboratory classes: 9h
Guided activities: 5h
Self study: 30h

Instantaneous power theory

Description:
This content is to provide students an overview of the Instantaneous Power Theory and its applications.

Full-or-part-time: 33h
Laboratory classes: 8h
Guided activities: 5h
Self study: 20h
Converter control (PLL, current control, reference calculation): balanced and unbalanced systems.

**Description:**
This content will provide students the essential knowledge to analyze balanced and unbalanced systems, focused on power converters application, including their control (PLL, current loop, reference calculation).

**Specific objectives:**
- PLL (Phase locked loop)
- Current loop
- Reference calculation
- Unbalanced system

**Related activities:**
A2. Simulink simulation of a converter connected to a balanced system
A3. Simulink simulation of a converter connected to an unbalanced system

**Full-or-part-time:** 33h
Laboratory classes: 8h
Guided activities: 5h
Self study: 20h

Matrix transforms: Park’ Transform

**Description:**
This content will introduce the main matrix transformations and they will be applied to a specific case: network and converter modelling.

**Related activities:**

**Full-or-part-time:** 15h
Laboratory classes: 5h
Self study: 10h

ACTIVITIES

**A1.- Simulation with Simulink of the transient response of a power converter**

**Full-or-part-time:** 7h
Laboratory classes: 2h
Guided activities: 5h

**A2.- Simulink simulation of a power converter connected to a balanced system**

**Full-or-part-time:** 9h 30m
Laboratory classes: 2h
Guided activities: 5h
Self study: 2h 30m
A3. Simulink simulation of a power converter connected to an unbalanced system

**Full-or-part-time:** 18h  
Laboratory classes: 3h  
Guided activities: 10h  
Self study: 5h


**Full-or-part-time:** 8h  
Laboratory classes: 3h  
Self study: 5h

**GRADING SYSTEM**

Written test (final exam) (PE): 50 %  
Oriented individual works (TD): 40 %  
Oral presentations (PO): 10%

**BIBLIOGRAPHY**

**Basic:**  

**Complementary:**  