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: Bergas Jane, Joan Gabriel
Others: Bergas Jane, Joan Gabriel

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
To provide students with the 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 is to give students with the necessary tools for the obtanion of the differential equations that describe a circuit.

**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 DC Motor.

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

**Instant power theory**

**Description:**
This content is to give students a brief overview on Instant Power Theory and its applications.

**Full-or-part-time:** 33h
Laboratory classes: 8h
Guided activities: 5h
Self study : 20h
Phase-lock loop (PLL's): single-phase and three-phas in unbalanced systems.

Description:
Nowadays, PLL's are the most used technique to synchronize Active Front End (AFE's) with main's voltages. This content will give an overview on PLL's, either single-phase or three-phase (in unbalances systems and with voltage sags).

Specific objectives:
.- SRF-PLL (Synchronous reference frame PLL).
.- DSRF-PLL (Doble Synchronous reference frame PLL).
.- Single-phase PLL (SOGI, ANF, others...)

Related activities:
A2. Simulink simulation of a single-phase PLL.

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

Matrix transforms: Park' Transform

Description:
In this content, the Matrix transform will be introduced and applied to a particular case: the transient modelling of a three-phase grid.

Related activities:

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

ACTIVITIES

A1.- Simulation with Simulink of the transient response of a DC Motor.

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

A2. Simulink simulation of a single-phase PLL.

Full-or-part-time: 9h 30m
Laboratory classes: 2h
Guided activities: 5h
Self study: 2h 30m

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: