Course guides
230678 - MOSIC - Mosic. Modelling, Simulation and Control of Power Electronic Systems

Unit in charge: Barcelona School of Telecommunications Engineering
Teaching unit: 710 - EEL - Department of Electronic Engineering.
Degree: MASTER'S DEGREE IN ELECTRONIC ENGINEERING (Syllabus 2013). (Optional subject). MASTER'S DEGREE IN ADVANCED TELECOMMUNICATION TECHNOLOGIES (Syllabus 2019). (Optional subject).
Academic year: 2021  ECTS Credits: 5.0  Languages: English

LECTURER
Coordinating lecturer: MIGUEL CASTILLA FERNÁNDEZ
Others: MIGUEL CASTILLA FERNÁNDEZ
JOSÉ LUIS GARCIA DE VICUÑA MUÑOZ DE LA NAVA

PRIOR SKILLS
Circuit analysis, Analog electronics, Digital Electronics, Power Electronics, Linear control analysis

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Transversal:
1. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

2. 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.

3. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

TEACHING METHODOLOGY
The course includes theory classes, which are oriented to introduce the initial knowledge, and exercises and laboratory classes, which are oriented to the application of the basic knowledge. The self study is guided by exercises and problems.
LEARNING OBJECTIVES OF THE SUBJECT

Learning objectives of the subject:

The aim of this course is to train students in methods of design, dimensioning and evaluation of power electronic systems.

Learning results of the subject:

- Ability to develop models and design nonlinear control schemes of power electronic systems.
- Ability to analyze and design power electronic systems in single-phase and three-phase applications.
- Ability to evaluate the performance of power electronic systems by simulation tools.
- Ability to program digital signal processors (DSP) for control purposes.
- Ability to develop techniques for the design, analysis and evaluation of electronic systems in applications such as automation, aerospace, energy distribution and generation, consumer electronics, biomedicine, etc.
- Ability to synthesize and solve problems related to the electronic engineering discipline, to apply learning techniques in complex and multiple contexts, to apply previous knowledge to new situations and contexts, as well as the ability to coordinate and work in a team.
- Ability to analyze, design and evaluate electronic systems for power control and energy conversion.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Hours large group</td>
<td>26.0</td>
<td>20.80</td>
</tr>
<tr>
<td>Self study</td>
<td>86.0</td>
<td>68.80</td>
</tr>
<tr>
<td>Hours small group</td>
<td>13.0</td>
<td>10.40</td>
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</tbody>
</table>

Total learning time: 125 h

CONTENTS

Modeling and control of three-phase power converters

Description:
- Space-phasor representation and frames
- Modeling of three-phase power converters
- Control of three-phase power converters

Related competencies:
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.

CT3. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

CT5. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

Full-or-part-time: 35h
- Theory classes: 8h
- Laboratory classes: 4h
- Guided activities: 10h
- Self study: 13h
### Simulation of three-phase power converters

**Description:**
- Unity-power-factor rectifiers
- Uninterruptible power supplies
- Active power filters

**Related competencies:**
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.

CT3. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

CT5. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

**Full-or-part-time:** 40h
- Theory classes: 8h
- Laboratory classes: 4h
- Guided activities: 8h
- Self study: 20h

### Modeling, simulation and control of electrical micro-grids

**Description:**
- Basic concepts of electrical micro-grids
- Hierarchical control
- Energy management in micro-grids

**Related competencies:**
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.

CT3. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

CT5. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

**Full-or-part-time:** 50h
- Theory classes: 10h
- Laboratory classes: 5h
- Guided activities: 8h
- Self study: 27h
GRADING SYSTEM

The course is evaluated according to the following items:
* Individual written exams (EXAM).
* Individual or in group exercises (EXER).
* Laboratory classes (LABO).
* Achievement of general and specific skills (SKIL).

The final mark (FM) is obtained using the following equation:

$$FM = 0.3 \times EXAM + 0.3 \times EXER + 0.25 \times LABO + 0.15 \times SKIL$$

BIBLIOGRAPHY

Basic:

Complementary: