Course guides
230366 - IPE - Introduction to Power Electronics

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).

Academic year: 2020  ECTS Credits: 2.5  Languages: Spanish, English

LECTURER

Coordinating lecturer: Biel Sole, Domingo
Guinjoan Gispert, Francisco Juan

Others: Biel Sole, Domingo
Guinjoan Gispert, Francisco Juan

REQUIREMENTS

Basic knowledge on linear circuits and systems as well as on electronic devices.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CEE1. Ability to understand and apply the principles of operation of power electronic systems in regulation, undulation and amplification applications.
CEE24. Ability to identify and evaluate innovative ideas and products in the area of electronic technology.
CEE12. Ability to use semiconductor devices taking into account their physical characteristics and limitations.
CEE4. Ability to design continuous and discrete time controllers for power electronic systems.

Transversal:
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.
CT2. SUSTAINABILITY AND SOCIAL COMMITMENT: Being aware of and understanding the complexity of the economic and social phenomena typical of a welfare society, and being able to relate social welfare to globalisation and sustainability and to use technique, technology, economics and sustainability in a balanced and compatible manner.

TEACHING METHODOLOGY

Master class
Autonomous work
Problems based learning

LEARNING OBJECTIVES OF THE SUBJECT

The course introduces the analysis and design techniques of power electronics circuits and their applications to the supply of electronic and electromechanical systems as well as in renewable energy systems.
**STUDY LOAD**

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self study</td>
<td>42.5</td>
<td>68.00</td>
</tr>
<tr>
<td>Hours large group</td>
<td>20.0</td>
<td>32.00</td>
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**Total learning time:** 62.5 h

**CONTENTS**

### Power electronics: why and where?

**Description:**
Objectives and application of power electronics

**Specific objectives:**
Introduction to electrical power processing. Definitions of energy, power and average power. The energy conversion chain: examples

**Related activities:**
Master class

**Full-or-part-time:** 4h 30m
Theory classes: 2h
Self study: 2h 30m

### Power processing circuits: objectives and circuit elements

**Description:**

**Specific objectives:**

**Related activities:**
Master class
Simulation lab exercise
Problems to solve.

**Full-or-part-time:** 10h
Theory classes: 2h
Self study: 8h
DC-DC Conversion: steady-state operation and components sizing

**Description:**

**Specific objectives:**

**Related activities:**
Master class
Simulation lab exercise
Problems to solve

**Full-or-part-time:** 24h
Theory classes: 8h
Self study: 16h

Dynamic modeling and control of power converters

**Description:**
Controlled sources switches modelling. PWM Modulators. Transfer functions deduction. Linear control design

**Specific objectives:**
Controlled, disturbances and control variables. Characterization of control variables. Models and averaged linearization.
Power Converter linearized model. Limitations. Linear controller design

**Related activities:**
Master class
Simulation lab exercise
Problems to solve

**Full-or-part-time:** 24h
Theory classes: 16h
Self study: 8h

GRADING SYSTEM

30% Simulation exercises + 30% proposed problems + 40% Final exam

BIBLIOGRAPHY

**Basic:**