Course guide
230656 - PEC - Power Electronic Circuits

Last modified: 08/03/2016

Unit in charge: Barcelona School of Telecommunications Engineering
Teaching unit: 710 - EEL - Department of Electronic Engineering.

Degree: **Academic year:** 2016 **ECTS Credits:** 5.0
Languages: English

LECTURER

Coordinating lecturer: FRANCESC GUINJOAN

Others: ALBERTO POVEDA, EDUARD ALARCÓN, DOMINGO BIEL

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

- Lectures
- Application classes
- Laboratory classes
- Laboratory practical work
- Group work (distance)
- Individual work (distance)
- Exercises
- Extended answer test (Final Exam)

LEARNING OBJECTIVES OF THE SUBJECT

Learning objectives of the subject:

The students will be introduced to the design oriented analysis, implementation and experimental validation of high efficiency power electronics circuits for the electrical power conversion and control. The course will also focus on the industry applications of these circuits such as: power supply of electronic/communication equipments and electromechanical systems, renewable energy systems.

Learning results of the subject:

- Ability to apply several energy sources, in particular the photovoltaic energy as well as the basis of electrotechnic and power electronics disciplines.
- Ability to apply power electronics as a support technology in other fields than ICT.
- Ability to design power supply and electrical energy conversion circuits for industry applications, telecommunications and computer-based systems.
- Ability to identify and model complex systems, to undertake qualitative analysis and approximations quantifying the uncertainty of the results as well as to suggest hypothesis and experimental procedures to validate them. Ability to identify the main system components and formulate design trade-offs and priorities.
- Ability to design experimental measurements for the operation validation of ICT equipments, systems and services. Ability to select proper software tools and hardware equipments to carry out data advanced analysis.

STUDY LOAD

Type	Hours	Percentage
Self study	86,0	68.80
Hours large group	26,0	20.80
Hours small group	13,0	10.40

Total learning time: 125 h

CONTENTS

1. Introduction to Power electronics

Description:
Main properties of electrical sources, loads and storage systems. Power conversion types. Elementary electronic circuits for power conversion. Ancillary circuits

Full-or-part-time: 5h
Theory classes: 1h
Laboratory classes: 2h
Self study : 2h

2. Steady-state analysis and design of power converters

Description:
Steady-state specifications of power converters. Power converter components design.

Full-or-part-time: 30h
Theory classes: 3h
Laboratory classes: 6h
Self study : 21h

3. Dynamical modelling and analysis of power converters and modulators for the design of the control subsystem

Description:
Controlled sources switch modeling. Model of the modulator PWM. Transfer functions of the power converter.

Full-or-part-time: 31h
Theory classes: 3h
Laboratory classes: 8h
Self study : 20h

4. Modelling and design of magnetic components

Description:
Equivalent magnetic circuit; reluctance concept. Inductor design, gaps. Transformer design.

Full-or-part-time: 25h
Theory classes: 3h
Laboratory classes: 2h
Self study : 20h

5. Applications

Description:
Power supply circuits for electronic and telecommunication equipments. Renewable energy applications.

Full-or-part-time: 34h
Theory classes: 3h
Laboratory classes: 10h
Self study : 21h

ACTIVITIES

LABORATORY

Description:
- Power converters simulation
- Power converters measurements
- Power converters design

EXTENDED ANSWER TEST (FINAL EXAMINATION)

Description:
- Theory Final examination.
- Laboratory Final examination.

GRADING SYSTEM

Theory Final examination: 33,4%
Laboratory Final examination: 33,3%
Laboratory assessments: 33,3%

BIBLIOGRAPHY

Basic:
- Erickson, R.W.; Maksimovic, D. Fundamentals of power electronics [on line]. 2nd ed. Dordrecht: Kluwer Academic Publishers, 2001 [Consultation: 11/02/2015]. Available on: http://link.springer.com/book/10.1007/b100747/page/1. ISBN 0792372700.

Complementary:
- Kassakian, J.G.; Schlecht, M.F.; Verghese, G.C. Principles of power electronics. Reading: Addison-Wesley, 1991. ISBN 0201096897.