Last update: 08-03-2016

230656 - PEC - Power Electronic Circuits

Coordinating unit: 230 - ETSETB - Barcelona School of Telecommunications Engineering

Teaching unit: 710 - EEL - Department of Electronic Engineering

Academic year: 2016

Degree: MASTER'S DEGREE IN TELECOMMUNICATIONS ENGINEERING (Syllabus 2013). (Teaching unit Optional)
MASTER'S DEGREE IN ELECTRONIC ENGINEERING (Syllabus 2013). (Teaching unit Optional)

ECTS credits: 5 Teaching languages: English

Teaching staff

Coordinator: 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

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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

Total learning time: 125h	Hours large group:	26h	20.80%
	Hours small group:	13h	10.40%
	Self study:	86h	68.80%

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Content

1. Introduction to Power electronics

Learning time: 5h
Theory classes: 1h
Laboratory classes: 2h
Self study : 2h

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

2. Steady-state analysis and design of power converters

Learning time: 30h
Theory classes: 3h
Laboratory classes: 6h
Self study : 21h

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

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

Learning time: 31h
Theory classes: 3h
Laboratory classes: 8h
Self study : 20h

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

4. Modelling and design of magnetic components

Learning time: 25h
Theory classes: 3h
Laboratory classes: 2h
Self study : 20h

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

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5. Applications	Learning time: 34h Theory classes: 3h Laboratory classes: 10h Self study : 21h

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

Planning of activities

LABORATORY

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

EXTENDED ANSWER TEST (FINAL EXAMINATION)

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

Qualification 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.