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

Last modified: 29/04/2020

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: 2020 **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

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

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 exercices (EXER).
* Laboratory classes (LABO).
* Achievement of generical and specific skills (SKIL).

La final mark (FM) is obtained using the following equation:
FM=0.3*EXAM+0.3*EXER+0.25*LABO+0.15*SKIL

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:
- Yazdani, A.; Iravani, R. Voltage-sourced converters in power systems: modeling, control, and applications [on line]. John Wiley and Sons, 2010 [Consultation: 18/07/2017]. Available on: http://onlinelibrary.wiley.com/book/10.1002/9780470551578. ISBN 9780470551578.
- Slotine; J.J.; Li, W. Applied nonlinear control. Englewood Cliffs, NJ: Prentice Hall, 1991. ISBN 9780130408907.