

230677 - EMD - Electric Motor Drives

Coordinating unit:	230 - ETSETB - Barcelona School of Telecommunications Engineering
Teaching unit:	710 - EEL - Department of Electronic Engineering
Academic year:	2015
Degree:	MASTER'S DEGREE IN ELECTRONIC ENGINEERING (Syllabus 2009). (Teaching unit Optional) MASTER'S DEGREE IN ELECTRONIC ENGINEERING (Syllabus 2013). (Teaching unit Optional) DEGREE IN ELECTRONIC ENGINEERING (Syllabus 1992). (Teaching unit Optional)
ECTS credits:	5
Teaching languages:	English

Teaching staff

Coordinator:	Arias Pujol, Antoni
Others:	JOSEP BORDONAU FARRERONS Busquets Monge, Sergio Pou Felix, Josep

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.
- CEE4. Ability to design continuous and discrete time controllers for power electronic systems.

Transversal:

1. 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.
2. 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
- Laboratory practical work
- Individual work (distance)
- Oral presentations
- Short answer test (Test)

Learning objectives of the subject

Learning objectives of the subject:

The aim of the course is to convey to the student a general picture of the state of the art in alternating current energy conversion technology and a fundamental understanding of the design and control of the associated power converters. Special emphasis will be given to popular applications such as renewable energy systems, electric vehicles, and industrial motor drives.

Learning results of the subject:

- Knowledge of the semiconductor devices and advanced topologies used in alternating current power converters.
- Knowledge of the typical applications of these power converters.

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- Knowledge of the modulation techniques for these power converters.
- Ability to design controllers for these converters in motor drives and grid-connected applications.
- Ability to model the conversion system to run numerical simulations and evaluate the system performance.
- 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 analyze, design and evaluate electronic systems for power control and energy conversion.

Study load

Total learning time: 125h	Hours large group:	26h	20.80%
	Hours medium group:	0h	0.00%
	Hours small group:	13h	10.40%
	Guided activities:	0h	0.00%
	Self study:	86h	68.80%

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Content

1. Introduction.	Learning time: 8h Theory classes: 1h Guided activities: 5h Self study : 2h
Description: Presentation of the course motivation, objectives, scope, and organization.	
2. Power Semiconductor Switching Devices.	Learning time: 10h Theory classes: 2h Guided activities: 5h Self study : 3h
Description: Presentation of the different power semiconductor switching devices used in ac power converters and their characteristics.	
3. Topologies.	Learning time: 8h Theory classes: 1h Guided activities: 5h Self study : 2h
Description: Synthesis of the different power converter topological structures from a general structure.	
4. Modulation Techniques for Single-Phase Dc-Ac Converters.	Learning time: 12h Theory classes: 3h Guided activities: 5h Self study : 4h
Description: Presentation and analysis of the main modulation techniques for single-phase dc-ac converters.	

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<p>5. Modulation Techniques for Three-Phase Dc-Ac Converters.</p>	<p>Learning time: 15h Theory classes: 4h Laboratory classes: 1h Guided activities: 5h Self study : 5h</p>
<p>Description: Presentation and analysis of the main modulation techniques for three-phase dc-ac converters.</p>	
<p>6. Modeling of Three-Phase Converters.</p>	<p>Learning time: 13h Theory classes: 3h Laboratory classes: 1h Guided activities: 5h Self study : 4h</p>
<p>Description: Derivation of the switching, average, and linear models of systems including three-phase converters. Use of these models.</p>	
<p>7. Control of Three-Phase Converters.</p>	<p>Learning time: 9h Theory classes: 1h Laboratory classes: 1h Guided activities: 5h Self study : 2h</p>
<p>Description: Design of conventional controllers for systems including three-phase converters.</p>	
<p>8. Multilevel Converters and Applications.</p>	<p>Learning time: 19h Theory classes: 5h Laboratory classes: 3h Guided activities: 5h Self study : 6h</p>
<p>Description: Presentation of the main multilevel converter families and their applications.</p>	

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<p>9. Matrix Converters and Applications.</p>	<p>Learning time: 20h Theory classes: 4h Laboratory classes: 6h Guided activities: 5h Self study : 5h</p>
<p>Description: - Topologies. - Features. - Modulation strategies. - Control Strategies. - Applications.</p>	
<p>10. Review, Discussion, and Advanced Topics.</p>	<p>Learning time: 11h Theory classes: 2h Laboratory classes: 1h Guided activities: 5h Self study : 3h</p>
<p>Description: Review of the course contents to engage the students in a discussion with the professor about the topics covered, and presentation of the current research trends in ac energy conversion.</p>	

Qualification system

Test: 40%
Individual assessments: 30%
Laboratory assessments: 30%

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Bibliography

Basic:

Mohan, N.; Undeland, T.M.; Robbins, P.W. Power electronics: converters, applications, and design. 3rd ed. New York: John Wiley and Sons, 2003. ISBN 0471226939.

Rashid, M.H. Power electronics: circuits, devices, and applications. 3rd ed. Upper Saddle River, NJ: Pearson/Prentice Hall, 2004. ISBN 0131011405.

Kazmierkowski, M.P.; Krishnan, R.; Blaabjerg, F. (eds.). Control in power electronics: selected problems [on line]. Amsterdam: Academic Press, 2002 [Consultation: 16/07/2013]. Available on: <<http://www.sciencedirect.com/science/book/9780124027725>>. ISBN 0124027725.

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:

Holmes, D.G.; Lipo, T.A. Pulse width modulation for power converters: principles and practice. Hoboken, NJ: John Wiley, 2003. ISBN 0471208140.

Others resources:

Papers published in the IEEE Transactions on Power Electronics, IEEE Transactions on Industrial Electronics, IEEE Transactions on Industry Applications, and analogous journals.