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820150 - SEES - Sustainable Electric Energy Systems

Coordinating unit: 295 - EEBE - Barcelona East School of Engineering

Teaching unit: 709 - EE - Department of Electrical Engineering

Academic year: 2015

Degree: BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Teaching unit Optional)
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Teaching unit Optional)
BACHELOR'S DEGREE IN ENERGY ENGINEERING (Syllabus 2009). (Teaching unit Optional)
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Teaching unit Optional)
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Teaching unit Optional)
BACHELOR'S DEGREE IN ENERGY ENGINEERING (Syllabus 2009). (Teaching unit Optional)
BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Teaching unit Optional)
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Teaching unit Optional)

ECTS credits: 6 Teaching languages: English

Teaching staff

Coordinator: Oriol Gomis Bellmunt

Others: Xavier Soler Pedemonte, Oriol Gomis Bellmunt

Prior skills

Knowledge on electrical circuits is highly recommended.

Requirements

Knowledge on electrical circuits is highly recommended.

Degree competences to which the subject contributes

Specific:

7. Understand and apply the theory of electrical circuits and machines.

8. Understand electrical power systems and their applications.

9. Understand the applications of renewable energies.

Transversal:

1. EFFECTIVE USE OF INFORMATION RESOURCES - Level 2. Designing and executing a good strategy for advanced searches using specialized information resources, once the various parts of an academic document have been identified and bibliographical references provided. Choosing suitable information based on its relevance and quality.
2. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 2. Using strategies for preparing and giving oral presentations. Writing texts and documents whose content is coherent, well structured and free of spelling and grammatical errors.
3. SELF-DIRECTED LEARNING - Level 2: Completing set tasks based on the guidelines set by lecturers. Devoting the time needed to complete each task, including personal contributions and expanding on the recommended information sources.
4. SUSTAINABILITY AND SOCIAL COMMITMENT - Level 2. Applying sustainability criteria and professional codes of conduct in the design and assessment of technological solutions.
5. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.

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6. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.

Teaching methodology

Students will develop practical exercises focusing on modeling and simulation of wind and PV systems. Different groups will select different schemes. The work undertaken will be presented to the other students along with a report with the obtained results.

Learning objectives of the subject

Electrical aspects of renewable energy and systems efficiency will be addressed, from technology description, modeling and control of the required electrical energy converters to sound related economics analysis.

Specific objectives:
1. Introduce the generation principles of the different renewable sources.
2. Introduce the different renewable energy sources focusing on photovoltaic solar and wind systems.
3. Delve into the electrical aspects of the treated energy sources: induction and synchronous generators, PV panels, etc¿
4. Work with energy conversion technologies to integrate renewable energies into the electrical grid or microgrid.
5. Focus on control techniques to maximize generation and control optimally the grid interconnection.
6. Analyze issues related to grid integration: voltage and frequency stability, effect of perturbations into the renewable source generation, etc¿
7. Analyze efficient electrical technology options and its economics.
8. Development of simulation based exercises

Study load

Total learning time: 150h	Hours large group:	30h	20.00%
	Hours medium group:	0h	0.00%
	Hours small group:	15h	10.00%
	Guided activities:	15h	10.00%
	Self study:	90h	60.00%

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Content

Introduction	Learning time: 12h Theory classes: 3h Self study : 9h
Wind Power	Learning time: 27h Theory classes: 6h Practical classes: 0h Guided activities: 3h Self study : 18h
Photovoltaic Power	Learning time: 27h Theory classes: 6h Guided activities: 3h Self study : 18h
Grid integration	Learning time: 33h Theory classes: 6h Practical classes: 6h Guided activities: 3h Self study : 18h
Electrical systems efficiency	Learning time: 51h Theory classes: 9h Practical classes: 9h Guided activities: 6h Self study : 27h

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Qualification system

FINAL MARK= 0,4*EF+0,15*AC1+0,15*AC2+0,15*AC3+0,15*AC4

EF Final Exam
AC Continuous evaluation
AC1 Report + Presentation 1
AC2 Report + Presentation 2
AC3 Report + Presentation 3
AC4 Report + Practices

Bibliography

Basic:

Lubosny, Z. Wind turbine operation in electric power systems: advanced modeling. Berlin [etc.]: Springer, cop. 2003. ISBN 354040340X.

Hau, E. Wind turbines: fundamentals, technologies, application and economics. 2nd ed. Berlin [etc.]: Springer, 2006. ISBN 3540242406.

Anaya-Lara, O. [et al.]. Wind energy generation : modelling and control. Chichester, U.K.: John Wiley and Sons, 2009. ISBN 9780470714331.

Freris, L. L.; Infield, D. G. Renewable energy in power systems. Chichester, U.K.: John Wiley and Sons, 2008. ISBN 9780470017494.

Complementary:

Ackermann, T. (ed.). Wind power in power systems. Chichester: John Wiley & Sons, cop. 2005. ISBN 0470855088.

Bianchi, Fernando D.; De Battista, Hernán.; Mantz, Ricardo J. Wind turbine control systems : principles, modelling and gain scheduling design. London: Springer, 2007. ISBN 9781846284922.

Jenkins, N. [et al.]. Embedded generation. London: The Institution of Electrical Engineers, cop. 2000. ISBN 0852967748.

Teodorescu, R.; Liserre, M.; Rodriguez Cortés, P. Grid converters for photovoltaic and wind power systems. Chichester, West Sussex: Wiley, 2011. ISBN 9780470057513.