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820342 - NTEDEN - New Technologies for Energy and Distribution

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

Teaching unit: 707 - ESAII - Department of Automatic Control

Academic year: 2016

Degree: BACHELOR'S DEGREE IN ENERGY ENGINEERING (Syllabus 2009). (Teaching unit Optional)
BACHELOR'S DEGREE IN ENERGY ENGINEERING (Syllabus 2009). (Teaching unit Optional)

ECTS credits: 6 Teaching languages: English

Teaching staff

Coordinator: PEDRO GOMIS ROMAN

Others: JORDI LLORCA PIQUE
JORDI SOLA SOLER

Opening hours

Timetable: The email of each teacher for inquiries will be published in ATENEA. Through the mail can request arranged hours of individualized attention

Degree competences to which the subject contributes

Specific:

1. Analyse and simulate specific energy systems.

2. Determine the best way to store energy on a case-by-case basis.

3. Explain current energy models, the various possibilities of reducing their global impact and the implications of energy for society.
4. Select the components of a control system.

Transversal:

5. 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

This course consists of 3-hours a week of classes, combining 2.5 hours of theoretical lectures with all the students and half an hour of practical applications in small groups. During the lectures, theoretical explanations will be combined with examples and active solving of exercises by the students. During the practical sessions the students will follow the teacher proposed practical activities. These activities and deliverable work will be finished during an additional weekly hour of guided activities and self-study.
Autonomous learning time during the term is very importance to complete the learning activities and deliverable work.

Learning objectives of the subject

At the end of the course, the student should be able to:

- Develop technical criteria to define an energy system which involved a storage device of energy from chemical data, biological materials, heat transfer and flow of matter and energy.

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- Analyze any kind of scientific and technological method of obtaining and manipulating energy using new technologies and express rules for its implementation, optimization and/or modification.
- Identify problems and deficiencies of energy installations and electrical devices and be able to provide engineering solutions.
- Analyze and characterize linear models of real systems.
- Design general purpose controllers and simulating energy control systems.

Study load

Total learning time: 150h	Hours large group:	37h 30m	25.00%
	Hours small group:	7h 30m	5.00%
	Guided activities:	15h	10.00%
	Self study:	90h	60.00%

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Content

Topic 1. New energy vectors: electricity, hydrogen binomial

Learning time: 40h

Theory classes: 10h
Practical classes: 2h
Guided activities: 4h
Self study : 24h

Description:
Hydrogen as an energy vector. Obtaining hydrogen by electrolysis, catalytic reforming, thermochemical cycles, photocatalytic methods and biological methods. Separation and purification of hydrogen. Methods of storage and transportation. Hydrogen production demand.

Specific objectives:
To develop technical criteria to define an energy system which involved a storage device of energy from chemical data, biological materials, heat transfer and flow of matter and energy.
To analyze any kind of scientific and technological method of obtaining and manipulating energy using new technologies and express rules for its implementation, optimization and/or modification.

Topic 2. Fuel Cells

Learning time: 30h

Theory classes: 7h 30m
Practical classes: 1h 30m
Guided activities: 3h
Self study : 18h

Description:
Fundamentals of fuel cells, general characteristics, parts and types. Using fuel cells in real applications.Tema 3. Control Systems Theory

Specific objectives:
Identify problems and deficiencies of energy installations and electrical devices and be able to provide engineering solutions.

Topic 3. Control Systems

Learning time: 40h

Theory classes: 10h
Practical classes: 2h
Guided activities: 4h
Self study : 24h

Description:
Linear models of real systems. Transfer function. Poles, zeros and system response. Block diagrams. Closed loop systems. Stability criteria. Controller design methods. PID controllers.

Specific objectives:
Analyze and characterize linear models of real systems.

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Topic 4 Modelling and simulation of energy control systems	Learning time: 40h Theory classes: 10h Practical classes: 2h Guided activities: 4h Self study : 24h

Description:
Applied control system models to assess the performance of energy systems using system modelling tools as Simulink.

Specific objectives:
Design general purpose controllers and simulating energy control systems

Qualification system

The evaluation will be conducted through the assessment of teachers of different topics, as follows:

Topics 1 and 2. Perform a final work (mini project 1) executed individually (MP1) (50%)
Topics 3 and 4. Accomplish deliverable work (DW) (25%) and perform a final assignment (mini project 2) made in group (MP2) (25%)

There will be no partial or final exams.

Final grade = 0.5 MP1 + 0.25 DW + 0.25 MP2

Bibliography

Basic:

Llorca, Jordi. El hidrógeno y nuestro futuro energético [on line]. Barcelona: Universitat Politècnica de Catalunya, 2010Available on: <http://hdl.handle.net/2099.3/36579>. ISBN 9788498804287.

Busby, Rebecca L. Hydrogen and fuel cells : a comprehensive guide. Tulsa, Okla: PennWell Corp, cop. 2005. ISBN 9781593700430.

Nise, Norman S.. Control systems engineering. 2nd ed. Redwood City, Calif: Benjamin/Cummings Pub. Co, cop. 1995. ISBN 0805354247.

Complementary:

Dorf, Richard C.; Bishop, Robert H. Modern control systems. 12th ed. Upper Saddle River [etc.]: Prentice Hall, cop. 2011. ISBN 9780136024583.