25222 - Clean technologies. Renewable energies

Información del Plan Docente

Academic Year	2016/17
Academic center	201 - Escuela Politécnica Superior
Degree	277 - Degree in Environmental Sciences
ECTS	6.0
Course	3
Period	First Four-month period
Subject Type	Compulsory
Module	---

1.Basic info

1.1.Recommendations to take this course

1.2.Activities and key dates for the course

2.Initiation

2.1.Learning outcomes that define the subject

2.2.Introduction

3.Context and competences

3.1.Goals

3.2.Context and meaning of the subject in the degree

3.3.Competences

3.4.Importance of learning outcomes

4.Evaluation

5.Activities and resources

5.1.General methodological presentation

The learning process is based on:

1) The participatory lecture technique (PLT) will be applied during the course of the theoretical sessions. Students will be encouraged to actively participate in the lectures by asking/answering questions and/or solve short exercises.

2) Group work and collaborative learning will be used during the course of the practical sessions, which will be focused on solving a series of problems and case studies.

3) The technical visits will provide students with demonstrable knowledge on the topics covered during the course.

4) A collaborative project integrating concepts and techniques will be performed by the students (in groups of 3 members).

5.2.Learning activities

- Theoretical sessions in the classroom (30 h).
- Practical sessions in the computer classroom (20 h).
- Technical visits (2 visits).
- Cooperative learning: during the practical sessions (in class) and the collaborative project (out of class).
- Autonomous learning (out of class): students will be encouraged to resolve several exercises and questionnaires related to the subjects covered in the classroom. They will post the solution on the Moodle site and interact with each other.
- Individual or small-group tutoring, which can be face-to-face (in the desk of lecturers) or virtual (using the Moodle platform).

5.3.Program

Theoretical sessions

1. Introduction: transfer of energy by means of heat and work, heat transfer mechanisms, energy and climate change.

2. Generating energy from fossil resources. Carbon combustion (effectiveness and environmental aspects), types of combustors, contaminant emissions control, clean coal technology.

3. Generating energy from biomass: concept of biomass and classification, thermal conversion of biomass (pyrolysis, combustion and gasification), alcoholic fermentation (obtaining bioethanol), producing biodiesel, anaerobic digestion, social and environmental aspects associated with the use of biomass energy.

4. Wind power: wind resources, power produced by a wind-driven generator, wind machines, components of a wind-driven generator, uses and environmental impact.

5. Solar Thermal Energy: uses of solar thermal energy, cylinder parabolic collectors, characteristic parameters, solar power tower.

6. Solar photovoltaic energy: semiconductors, photovoltaic panels, accumulation subsystems, regulation and power adaptation, dimensioning of photovoltaic systems.

Practical sessions (resolution of 10 problems/case studies related to the subjects above).

5.4.Planning and scheduling

Schedule

Universidad Zaragoza

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Week	Theoretical sessions	Practical sessions	Visits
1	Introduction (1 h) Topic 1 (1 h)	Establishment of the work groups and definition of the collaborative project (2 h)	
2	Topic 1 (2 h)	Session 1 (2 h)	
3	Topic 2 (2 h)	Session 2 (2 h)	
4			
5	Topic 2 (2 h)	Session 3 (2 h)	
6	Topic 2 (2 h)	Session 4 (2 h)	
7	Topic 3 (2 h)		
8	Topic 3 (2 h)	Session 5 (2 h)	
9	Topic 4 (2 h)	Session 6 (2 h)	
10	Topic 4 (2 h)	Session 7 (2 h)	
11	Topic 5 (2 h)	Session 8 (2 h)	Visit (6 h)
12	Topic 5 (2 h)		
13	Topic 5 (1 h) Topic 6 (1 h)	Session 9 (2 h)	
14	Topic 6 (2 h)	Session 10 (2 h)	
Christmas holidays			

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15		Oral presentation of the collaborative projects (2 h)	

Workload

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Activity	Classroom hours	Factor	Out of class hours
Theoretical sessions	26	1,5	39
Practical sessions	20	1,5	30
Collaborative work	4	-	25
Technical visits	6	-	-
Total	56		94
Total Workload	**150 h**		

5.5.Bibliography and recomended resources

Basic Textbooks:

- Çengel, Yunus A.; Boles, Michael A. Thermodynamics: an engineering approach. 6th Edition. New York: McGraw Hill Education, 2007.
- González Velasco, Jaime. Energías renovables. Barcelona: Reverté, D.L., 2009.

Complementary Textbooks:

- Çengel, Yunus A. Heat transfer: a practical approach. 3rd Edition. New York: McGraw Hill Education, 2006.
- Quaschning, Volker. Understanding Renewable Energy Systems. 1st. ed. London: Earthscan, 2005.
- Twidell, John. Renewable energy resources. 2nd ed. New York: Taylor & Francis, 2006.

Recommended links:

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European Commision-Energy

Instituto para la Diversificación y Ahorro de la Energía, IDAE

National Renewable Energy Laboratory, NREL

Plan de Energías Renovables 2005-2012. Ministerio de Industria, Turismo y Comercio

Portal de las Energías Renovables,CIEMAT