# Guía docente de la asignatura

## Academic year: 2016/2017

| | | | |
|---|---|---|---|
| **Subject** | THE ENVIRONMENT AND RENEWABLE ENERGY | | |
| **Degree** | INDUSTRIAL ENGINEERING INTERNATIONAL SEMESTER | | |
| | TRANSVERSAL COURSE FOR THE SEVEN BACHELOR'S DEGREES TAUGHT IN INDUSTRIAL ENGINEERING | | |
| **Code** | 75003 | | |
| **Semester** | Second semester | | |
| **Type** | Optional | | |
| **ECTS credits** | 6 | | |
| **Lenguage** | English | | |
| **Teaching staff (contact information)** | *Raul Muñoz* | *Venue: Doctor Mergelina* | *mutora@iq.uva.es* |
| | *Pedro Garcia Encina* | | *pedro@iq.uva.es* |
| | *Fernando A. Frechoso* | *Venue: F^co Mendizábal* | *frechoso@eii.uva.es* |
| | *Julián M. Pérez* | | *julian@eii.uva.es* |
| **Departments** | | | |
| | Electrical Engineering | | |

## A. Objectives

- Students will be introduced to environmental impacts of the industrial activity and waste minimization
- Students will know the solar photovoltaic energy, how it works and the main types of PV systems.
- Students will be able of identify the component parts of a photovoltaic system.
- Students will understand the differences between an isolated, grid connected and own-consumption photovoltaic system.
- Students will learn the basis of sustainability, life cycle Assessment and design for the environment

## B. Learning Units

### 1.- Industrial activity and Environment

- Introduction to air, water and soil pollution
- Hazardous waste management
- Natural resources depletion
- Environmental policies
- Pollution prevention and waste minimization
- Best Available Techniques
- Sustainability
- Introduction to sustainability metrics

**Basic bibliography:**


- Edward S. Rubin. Introduction to Engineering and the Environment. McGraw-Hill International Edition 2001
- Paul L. Bishop. Pollution prevention: Fundamentals and Practice. McGraw-Hill International editions. 2000
- The Sustainability Metrics: Sustainable Development Progress Metrics for use in Process Industries. Institution of Chemical Engineers (www. Icheme.org)
- Best Available Techniques. Reference documents under the IPPC Directive and the IED (http://eippcb.jrc.ec.europa.eu/reference/)


### 2.- Photovoltaic systems

- Introduction
- General description of PV systems
- Basic concepts of electricity
- PC software package for the study, sizing and data analysis of PV systems (PVSyst).
- PV panel: I-V and P-V curves.
- Laboratory stand alone PV system.
- Laboratory grid connected PV system.
- Laboratory own-consumption PV system.

**Basic bibliography:**

- ABB. "Cuaderno de aplicaciones técnicas nº 10: Plantas fotovoltaicas". 2011.
- Fernández Salgado, J.M., "Guía completa de la Energía Solar Fotovoltaica". AMV ediciones 2007.
- IDAE (Instituto para la Diversificación y Ahorro de la Energía). "Manuales de energías Renovables. Energía Solar Fotovoltaica". Ed. IDAE. Madrid, 1996.


**Complementary bibliography:**


- ASIF. "Sistemas de Energía Fotovoltaica. Manual del Instalador". Progensa 2005.
- EREN (Ente Regional de la Energía de Castilla y León). "Manual de Energía Solar Fotovoltaica: Manual del Instalador". Junta de Castilla y León. 2004.
- Lorenzo Pigueras, Eduardo- "Electricidad solar fotovoltaica. 3, Radiación solar y dispositivos fotovoltaicos", Sevilla, Progensa 2006.
- Lorenzo Pigueras, Eduardo. "Electricidad Solar. Ingeniería de los sistemas fotovoltaicos". Instituto de Energía Solar. Universidad Politécnica de Madrid. Ed. Progensa. Sevilla, 1994.
- Martínez Jiménez, Amador. "Dimensionado de Instalaciones solares fotovoltaicas". Ediciones Paraninfo S.A. 2012.
- Revista "Era Solar". Ed. SAPT Publicaciones Técnicas S.L. Madrid


### 3.- Life Cycle Assessment and Design for the Environment

- Introduction to LCA: History of LCA, objective and structure
- Goal definition and Scoping Stage
- Inventory Analysis
- Impact analysis
- Improvement analysis
- Design for the environment
- Common guidelines in eco-design
- Biomimicry
- Green Chemistry

**Basic bibliography:**


- Paul L. Bishop. Pollution prevention: Fundamentals and Practice. McGraw-Hill International editions. 2000
- http://www.ted.com/
- Guinee et al (2001) Life cycle assessment – an operational guide to the ISO standards.
- Prepared by CML, Leiden University, The Netherlands.
- Hertwich E (2011), from lectures in NTNU PhD course Life-cycle assessment and Environmental Systems Analysis EP8108, October 2011
- Hertwich EG and Hammitt JK (2001), A Decision-Analytic Framework for Impact Assessment,International Journal of Life Cycle Assessment, 2001, 6(5), pp. 265-271.


## C. Teaching and Learning Methods:

The course consists of 3 learning units; each one is divided into theoretical lessons, practices, in-group corrections or checking, concerted tutorials and technical visits.

The lectures will mainly use oral presentation for teaching the fundamental knowledge of the subject. Active student participation will be encouraged.

The practical lessons will support the understanding and assimilation of the concepts provided in theoretical lectures. The assignments will be done individually or in small groups, depending on the activity and the number of students enrolled. Some of the works will be done in the classroom and at home. The assignments of each learning unit will be presented to the lecturer and other students and handed in to the teacher within the deadlines indicated in the schedule presented at the beginning of the course

Tutorials will involve personal assistance and will be carried out individually or in small groups, previously arranged, in order to monitor the proper development of the work prior to final assignment submission.

The visits will take place in full-scale industrial facilities in order to understand the differences between real and lab-scale systems.

## D. Activities evaluated and grading system:

- The evaluation of students in ordinary call will be held according to the following parameters:
  - Attendance: 25% (It is obligatory to attend at least 80% of classes).
  - Activities and Works made in Learning Unit 1: 25%
  - Activities and Works made in Learning Unit 2: 25%
  - Activities and Works made in Learning Unit 3: 25%

  It is essential to pass each individual unit in order to pass the course

- The evaluation of students in extraordinary call will be held according to the following parameters:
  - Exam of the contents presented in lectures: 25%
  - Activities and Works made in Learning Unit 1: 25%
  - Activities and Works made in Learning Unit 2: 25%
  - Activities and Works made in Learning Unit 3: 25%

  It is essential to pass each individual unit in order to pass the course

## E. Additional Considerations: