# Photovoltaic solar energy

**Academic Year: ( 2019 / 2020 )** **Review date: 16/05/2017 11:38:12**

**Department assigned to the subject: Electrical Engineering Department**

**Coordinating teacher: CHINCHILLA SANCHEZ, MONICA**

**Type: Compulsory ECTS Credits : 6.0**

**Year : 1 Semester : 1**

## REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Electric Circuits and Fundamentals of Electric Machines

## OBJECTIVES

Competences:
- Acquire adequate knowledge of Renewable Energies: resources and technology. They must know in more detail those energies more frequent in our environment: wind energy, solar thermal energy and solar photovoltaic.
- Design, calculate and design products, processes, facilities and renewable energy plants.
- Conduct research, development and innovation in products, processes and methods related to renewable energies.
- Follow the technological evolution of renewable energies and have a prospective knowledge of this evolution.
-To be aware of the social and energy needs of renewable energies, as well as the advantages and disadvantages of photovoltaic solar energy in relation to these needs.
-To have knowledge of the basic technology associated to the use of the solar radiation for electricity generation (constituent parts) and its evolution.
- To know how to design, calculate and dimension photovoltaic solar energy installations: students who pass this subject will be able to carry out a selection, analysis, and dimensioning of photovoltaic systems, both those connected to the grid and autonomous photovoltaic systems. They will use or design software specific to each case. They will also know to select the most appropriate components for each application within the commercially available
-To have knowledge of the regulations that directly affect the use of solar photovoltaic energy.
-They will acquire the ability to develop in practice a particular photovoltaic solar energy project: from the use of selection of devices, use of standards, catalogs and commercial technical documentation, until its implementation in the field.

## DESCRIPTION OF CONTENTS: PROGRAMME

1.- Photovoltaic energy. Basic statements and present technology.
1.1. Applications
1.2- PV around the world
1.3 Spanish case
2.- Solar resource. Introduction.
2.1. Definitions
2.2.Solar radiation
2.3. Solar path. Measurements and instrumentation.
3.-Solar cell.
3.1.Actual technology
3.2. Types and characteristics
3.3 Equivalent cell model
4.- Photovoltaic modules.
4.1.Types and characteristics.
4.2.Power curve.Radiation and temperature. Maximum power tracking.
4.3.Test.

5. Inverters
5.1-Types and function
5.2- Efficiency
5.3- Selection.Regulation
6. PV generators
6.1 Module association
6.2. Maximum Power Point Tracking
7. Accumulation systems
7.1 Types
7.2 Models
7.3 Selection
8- Protections
9.- Solar power tracking.
9.1- Clasification
9.2- Energy improvement.Examples.
10- Arquitectural integration
10.1.Definitions. Shading losses, not optimal tilt and orientation.
10.2. PV support structures (roofs, walls, ground) facilities. Examples.
11.-Stand-alone photovoltaic energy systems.
11.1- Components. Batteries. Charge regulators. AC/DC Inverters (PWM, Maximum point power tracking).
11.2- Problems. Sizing.
12.- Urban PV Systems.
13 - Grid connected photovoltaic energy systems
13.1-Types.
13.2.Power devices in Grid connected photovoltaic energy systems.
13.3. Sizing. Retscreen and PVSyst simulation software.
13.4. Grid integration
13.5. Operation and Maintenance.
14.-Regulation.
15.- Technical project. Grid connected photovoltaic energy system: example. PVSyst.
- Technical projects; examples.
16. Microgrids. Introduction. Sw Homer Pro.

## LEARNING ACTIVITIES AND METHODOLOGY

-Teacher and industrial experts lessons, doubts resolution classes -in reduced groups-, students presentations, individual mentorship and student work to acquire theoretical concepts.
Lab and simulation lessons also be provided.

## ASSESSMENT SYSTEM

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|---|---|
| **% end-of-term-examination/test:** | 50 |
| **% of continuous assessment (assigments, laboratory, practicals…):** | 50 |

A continuous assessment based on the completion of several tasks, students participation and tests that value both skills and general knowledge;
Ordinary: from 50% continuous assessment (two individual works) and 50% a partial exam.
Extra-ordinary: from 50% continuous assessment (two individual works) and 50 %Final exam.

## BASIC BIBLIOGRAPHY

- Jose M. Fernandez Salgado Guia Completa de la Energía Solar Fotovoltaica, AMV Ediciones, 2007

## ADDITIONAL BIBLIOGRAPHY

- Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas Fundamentos,dimensionado y aplicaciones de la Energia solar fotovoltaica, Editorial del Ciemat, 2005

- Luis Castañer Muñoz Energia Solar Fotovoltaica, Ediciones UPC, 1994