Photovoltaic solar energy

Academic Year: (2020 / 2021) **Review date: 16-12-2020**

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:
CB6 Possess and understand knowledge that provides a basis or opportunity to be original in the development and / or application of ideas, often in a research context
CB7 That students know how to apply the acquired knowledge and their ability to solve problems in new or little-known environments within broader (or multidisciplinary) contexts related to their area of ¿¿study
CB8 That students are capable of integrating knowledge and facing the complexity of formulating judgments based on information that, being incomplete or limited, includes reflections on social and ethical responsibilities linked to the application of their knowledge and judgments
CB9 That students know how to communicate their conclusions and the knowledge and ultimate reasons that support them to specialized and non-specialized audiences in a clear and unambiguous way
CB10 That students possess the learning skills that allow them to continue studying in a way that will be largely self-directed or autonomous.
- Acquire adequate knowledge of renewable energy: resources and technology. They should know in more detail the most frequent energies in our environment: wind energy, thermal solar energy and photovoltaic solar energy.
- Project, calculate and design renewable energy products, processes, facilities and plants.
- Carry out research, development and innovation in products, processes and methods in relation to renewable energies.
- Follow the technological evolution of renewable energies and have prospective knowledge of this evolution.
-Knowledge of the social and energy needs of renewable energies, as well as the advantages and disadvantages of photovoltaic solar energy in relation to those needs.
-Have knowledge of the basic technology associated with the use of the sun for electricity generation (constituent parts) and its evolution.
-Know how to project, calculate and size photovoltaic solar energy installations: students who pass this subject will be able to make a selection, analysis, and dimensioning of photovoltaic systems, both those connected to the electricity supply network and autonomous photovoltaic systems. They will use or design specific software for each case. They will also know how to select the most appropriate components for each application within those commercially available
- Carry out research, development and innovation in products, processes and methods in relation to photovoltaic solar energy.
- Manage technically and economically projects, facilities, plants, companies and technology centers related to photovoltaic solar energy.
-Know the regulations that directly affect the use of photovoltaic solar energy.
-They will acquire the ability to develop in practice a specific photovoltaic solar energy project: from the use of device selection, use of regulations, catalogs and commercial technical documentation, to its implementation in the field, using computer programs.
-Follow the technological evolution of photovoltaic solar energy and have prospective knowledge of this evolution.
- Knowledge of the social and energy needs of photovoltaic solar energy, as well as its advantages and disadvantages
- Understanding the constituent parts of photovoltaic plants.
- Ability to evaluate the solar resource in a certain location, as well as to determine the environmental impact of the renewable energy project.

DESCRIPTION OF CONTENTS: PROGRAMME

1.- Photovoltaic energy. Basic statements and present technology.

2.- Solar resource. Introduction.
2.1. Definitions
2.2.Solar radiation
2.3. Solar path. Measurements and instrumentation.
2.4 Irradiation models.

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.

10.-Stand-alone photovoltaic energy systems.
10.1- Components. Batteries. Charge regulators. AC/DC Inverters (PWM, Maximum point power tracking).
10.2- Problems. Sizing.
11.- Urban PV Systems.
12. Net meetering
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.PVDesign
- 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.
Simulation lessons also be provided.

ASSESSMENT SYSTEM

A continuous assessment based on the completion of several tasks, students participation and tests that value both skills and general knowledge; 100% continuous assessment (three individual works)

% end-of-term-examination:	0
% of continuous assessment (assigments, laboratory, practicals…):	100

BASIC BIBLIOGRAPHY

- Deutsche Gesellschaft Für Sonnenenergie Planning and Installing Photovoltaic Systems, EarthScan, 2008

- 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