Course guide
230679 - PVS - Photovoltaic Systems

Last modified: 25/05/2023

Unit in charge: Barcelona School of Telecommunications Engineering
Teaching unit: 710 - EEL - Department of Electronic Engineering.

Degree: MASTER'S DEGREE IN ELECTRONIC ENGINEERING (Syllabus 2013). (Optional subject).
MASTER'S DEGREE IN ADVANCED TELECOMMUNICATION TECHNOLOGIES (Syllabus 2019). (Optional subject).
MASTER'S DEGREE IN ELECTRONIC ENGINEERING (Syllabus 2022). (Optional subject).

Academic year: 2023 **ECTS Credits:** 5.0 **Languages:** English

LECTURER

Coordinating lecturer: Consultar aquí / See here: https://telecos.upc.edu/ca/estudis/curs-actual/professorat-responsables-coordinadors/responsables-assignatura

Others: Consultar aquí / See here: https://telecos.upc.edu/ca/estudis/curs-actual/professorat-responsables-coordinadors/professorat-assignat-idioma

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Transversal:
1. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.

2. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

TEACHING METHODOLOGY

Teaching methodology

The course teaching methodologies are as follows:

- Lectures and conferences: knowledge exposed by lecturers or guest speakers.
- Participatory sessions: collective resolution of exercises, debates and group dynamics, with the lecturer and other students in the classroom; classroom presentation of an activity individually or in small groups.
- Theoretical/practical supervised work: classroom activity, carried out individually or in small groups, with the advice and supervision of the teacher.
- Homework assignment of reduced extension: carry out homework of reduced extension, individually or in groups.
- Homework assignment of broad extension (PA): design, planning and implementation of a project or homework assignment of broad extension by a group of students, and writing a report that should include the approach, results and conclusions.

Training activities:
The course training activities are as follows:
Face to face activities
- Lectures and conferences: learning based on understanding and synthesizing the knowledge presented by the teacher or by invited speakers.
- Participatory sessions: learning based on participating in the collective resolution of exercises, as well as in discussions and group dynamics, with the lecturer and other students in the classroom.
- Presentations (PS): learning based on presenting in the classroom an activity individually or in small groups.
- Theoretical/practical supervised work (TD): learning based on performing an activity in the classroom, or a theoretical or practical exercise, individually or in small groups, with the advice of the teacher.

Study activities
- Homework assignment of reduced extension (PR): learning based on applying knowledge and presenting results.
- Homework assignment of broad extension (PA): learning based on applying and extending knowledge.
- Self-study (EA): learning based on studying or expanding the contents of the learning material, individually or in groups, understanding, assimilating, analysing and synthesizing knowledge.

LEARNING OBJECTIVES OF THE SUBJECT

Learning objectives of the subject:

The aim of this course is to train students in photovoltaic systems First, we consider the building blocks and describe them taking into account state of the art solar cells and PV modules and the characteristics dependence with irradiance and temperature Then, using this knowledge, sizing criteria will be described as well as the operating yields. Power electronics components will also be described

Learning results of the subject

- Ability to specify and design PV systems for stand alone, grid connected and water pumping applications.
- Ability to calculate the energy performance analysis, return of investment and system reliability
- Ability to understand operation of state of the art solar cells in flat panel or concentrating systems
- Ability to develop techniques for the design, analysis and evaluation of electronic systems in applications such as automation, aerospace, energy distribution and generation, consumer electronics, biomedicine, etc.
- Ability to analyze, design and evaluate electronic systems for power control and energy conversion.
- Ability to understand a photovoltaic system and its components as long a the criteria used to size such systems.

STUDY LOAD

Type	Hours	Percentage
Hours large group	26,0	20.80
Hours small group	13,0	10.40
Self study	86,0	68.80

Total learning time: 125 h

CONTENTS

1. Introduction: Solar energy and PV systems

Description:
- Solar energy and renewable sources
- Solar energy availability
- Building blocks of a PV system

Full-or-part-time: 16h
Theory classes: 4h
Self study : 12h

2. Photovoltaic cells and modules

Description:
- Solar cell operation and main characteristics
- PV modules and PV plants
- Available technologies

Full-or-part-time: 20h
Theory classes: 4h
Self study : 16h

3. Main components of a PV system

Description:
- Modules, batteries, DC/DC converters and DC/AC converters
- Safety and monitoring components and measuring systems
- Simulation models

Full-or-part-time: 20h
Theory classes: 4h
Self study : 16h

4. Stand-alone and water pumping PV systems

Description:
- Sizing , best practice recommendations
- Applications
- Available technologies

Full-or-part-time: 24h
Theory classes: 5h
Laboratory classes: 7h
Self study : 12h

5. Grid connected PV systems

Description:
- Inverters characteristics and guidelines for sizing and design
- Long term simulations
- Operation and performance parameters

Full-or-part-time: 26h
Theory classes: 5h
Laboratory classes: 6h
Self study : 15h

6. PV Market analysis and legal incentives for PV expansion

Description:
- Grid parity and feed-in tariff
- Global market analysis and worldwide trends

Full-or-part-time: 19h
Theory classes: 4h
Self study : 15h

GRADING SYSTEM

35 % Personal work & Oral presentation
30 % Tasks & Exercises
35 % Laboratori Practices

BIBLIOGRAPHY

Basic:
- Castañer Muñoz, L.; Silvestre Berges, S. Modelling photovoltaic systems: using PSpice. Chichester: John Wiley & Sons, 2002. ISBN 0470845287.