Universidad Zaragoza

Academic Year/course: 2022/23

66372 - Photovoltaic power systems

Syllabus Information

Academic Year: 2022/23
Subject: 66372 - Photovoltaic power systems
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
Degree: 636 - Master's in Renewable Energies and Energy Efficiency
ECTS: 3.0
Year: 1
Semester: Second semester
Subject Type: Optional
Module:

1. General information

1.1. Aims of the course

The aims of this subject are:

- Show the student basic knowledge about the use of electrical energy, as well as the use of electrical and electronic devices in industrial applications.
- Identify and distinguish the different types of power converters, as well as their modes of operation and control.
- Understand the basic operation and limitations of the circuits presented.
- Qualitatively and quantitatively analyze electrical power circuits. Present a set of commonly used elementary circuit blocks

These approaches and objectives are aligned with some of the Sustainable Development Goals, SDG, of the 2030 Agenda (https://www.un.org/sustainabledevelopment/es/) and certain specific goals, in such a way that the acquisition of the Learning outcomes of the subject provides training and competence to the student to contribute to a certain extent to their achievement:

Goal 7: Affordable and clean energy

Target 7.1. By 2030, ensure universal access to affordable, reliable, and modern energy services

Target 7.2. By 2030, significantly increase the share of renewable energy in the energy mix

Target 7.3. By 2030, double the global rate of improvement in energy efficiency

Goal 9: Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation

Target 9.5. Increase scientific research and improve the technological capacity of industrial sectors in all countries, in particular developing countries, including by fostering innovation and significantly increasing, by 2030, the number of people working in research and development per million inhabitants and public and private sector spending on research and development

1.2. Context and importance of this course in the degree

The course provides knowledge to analyze, develop and design power systems used in industry; especially regarding electronic power systems intended for use with renewable energy sources.

1.3. Recommendations to take this course

To carry out this module, you need advanced knowledge of electrical engineering, electronics, control and electrical machines (level of industrial technical engineer, electrical branch or industrial and automatic electronics).

2. Learning goals

2.1. Competences

Upon passing the subject, the student will be more competent to ...

Specific Competences:

CE1.- Use and develop methodologies, methods, techniques, programs for a specific use, norms and computing standards.

CE2.- Develop and execute renewable energy projects.

CE3.- Assess the importance and implications of energy use in the development of society.

CE10.- Plan solar exploitation systems (thermal and electrical).

CE17.- Calculate electric power generation, transport and distribution systems, and the integration of renewable energies in each.

General Competences:

CG2.- Carry out research, development and innovation in products, processes and methods concerning renewable energies.

CG7.-Assess the application of emerging technologies in energy and the environment.

2.2. Learning goals

The student, to pass this subject, must demonstrate the following results ...

- Identify and distinguish the different types of power converters, as well as their modes of operation and control.
- Know the methodologies and tools for the simulation of converters applied to photovoltaic systems.
- Apply the knowledge acquired in the control and conversion of power systems.
- Being able to explain the fundamental problems of high power electronic conversion.

2.3. Importance of learning goals

The Master's in Renewable Energies and Energy Efficiency is an introductory master's degree in research. The focus of the program is technological and it is intended that students are able to develop knowledge of technologies and design skills, as well as the most appropriate use of energy resources.

3. Assessment (1st and 2nd call)

3.1. Assessment tasks (description of tasks, marking system and assessment criteria)

The student must demonstrate that they have achieved the expected learning outcomes through the following assessment activities

You can choose one of the following two evaluation options. These options are exclusive: global evaluation and continuous evaluation.

Option 1: (Overall evaluation)

Students who choose this form of assessment will have to take a final written and individual exam with various theoretical-practical questions and problems in which they can demonstrate that they have achieved the proposed learning competences. This test will be scheduled within the exam period corresponding to the first or second call.

Option 2: (Continuous evaluation)

Students will be evaluated throughout the teaching period of the subject by completing different exercises:

- Small theoretical-practical tests of the basic concepts of each topic.
- Carrying out and commenting on laboratory practices.
- Realization and discussion of practical cases.
- Development of different teaching activities.
- Supervised works of introduction to research.

This option can only be selected in the first call (ordinary option). Students who present themselves in the second call (extraordinary option) must be evaluated using option 1.

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The methodology followed in this course is oriented towards achievement of the learning objectives. During the theory sessions the basic concepts are explained. Exercises and applied problems are also developed in the classroom blackboard. Their purpose is to improve understanding of the different concepts. The methodology is based on the development of academic activities and tasks as concept-tests, theory pills, challenge problem, simulation software, among others.

4.2. Learning tasks

The course includes the following learning tasks:

- Theory and practice sessions. Lectures with problem sessions and cases of actual application. Student participation through questions and brief discussions is encouraged.
- Practice sessions. The student will have the instructions of the laboratory practice, previously provided at the start of the session. The teacher provides the information necessary for its development and implementation.
- Supervised tasks. The teacher presents students with the solution to a set of problems and real cases related to different topics. These academic tasks are related to the course contents.
- Autonomous work. Its purpose is to encourage the continued study of the student, so the different academic activities are distributed throughout the semester.
- Evaluation tests. The different evaluation activities are used to check the degree of compression and assimilation of knowledge. Its purpose is to determine the skills, abilities and competences acquired by the student.
- Tutorials. Hours for student guidance, identification of learning problems, orientation in the course, review exercises and assignments, etc.

4.3. Syllabus

The course will address the following topics:

Theory sessions

Topic 0.- Introduction.
Topic 1.- Photovoltaic Systems. Modelling and Simulation.
Topic 2.- Dimensioning and Control Models.
Topic 3.- Architectures and Topologies of DCDC Converters in Photovoltaic Systems.
Topic 4.- Generalities and Converter Applications.

Practice sessions

- a. Introduction to the use of commercial simulation software for devices and topologies in permanent and transient mode. Solving some basic examples.
- b. Introduction of commercial simulation software to estimate losses on different devices. Application Examples.

4.4. Course planning and calendar

Theory and problems are taught together with the practice sessions according to the schedule established by the School.

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course, will be provided on the first day of class or please refer to the EINA website.

4.5. Bibliography and recommended resources

http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=66341