Universidad Zaragoza

Academic Year/course: 2024/25

30038 - Smart Electrical Grids

Syllabus Information

Academic year: 2024/25
Subject: 30038 - Smart Electrical Grids
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
Degree: 436 - Bachelor's Degree in Industrial Engineering Technology
ECTS: 6.0
Year: 4
Semester: Second semester
Subject type: Optional
Module:

1. General information

The energy system has begun a process of transition to a new paradigm characterized by decarbonization, decentralization of generation, electrification of the economy, more active participation of consumers and a more sustainable use of resources . Maintaining the traditional scheme of a centralized passive power system may hinder this process, so it is necessary to rethink power systems in order to facilitate the integration of various power generation systems together with storage systems, and to implement demand side management (DSM) and grid supervisor side measures. The objective of this subject is to familiarize the student with the concepts on which the evolution of electrical systems will be based.

These approaches and objectives are aligned with some of the Sustainable Development Goals, SDGs, of the 2030 Agenda, and in particular

Goal 7. Affordable and clean energy (Objectives 7.1, 7.2 and 7.3) and Goal 12. Responsible production and consumption (Objective 12.2)

2. Learning results

The student, in order to pass this subject, must demonstrate the following results:

- Learn about the advantages of active smart grids in urban, rural and industrial environments in terms of operation and efficiency.

- Identify, classify, describe and select distributed generation and storage systems, as well as the problems associated with the integration of distributed generation into current distribution networks.

- Identify, classify and describe the different elements that are part of Smart Grids and Microgrids, their typologies and the agents involved in their control and management.

- Understand the constraints associated with current protection systems in the introduction of distributed resources and know the technical solutions available.

The knowledge acquired in this subject will give the student a basic perspective that can be of help when it comes to joining companies that work directly in the integration of renewable energies and distributed generation.

3. Syllabus

1. Introduction: Electric Power in the general energy scenario, current situation and its evolution

2. Smart grids: Smart Grids: the concept. Actors involved. Distributed energy resources.

Electricity demand. Demand management

Distributed Generation (DG). Definition and essential characteristics. Benefits and challenges. DG integration in electrical systems

Storage systems for connection to distribution networks

Electric vehicles, a driving force for smart grids

3. Self-consumption, Energy Communities, Virtual Power Plants and Microgrids.

4. Academic activities

Lectures: 35 hours: Theoretical-practical sessions in which the contents of the subject will be explained. The methodology is based on lectures, with discussions in which students participate

Problems and cases: 10 hours. Classroom resolution of proposed problems

Laboratory practices: 15 hours. Students must study and analyse documentation on various topics related to the subject , use computer tools that will be provided and apply the knowledge acquired to respond to the practice scripts.

Personal study. 60 hours

Assessment tests. 6 hours

5. Assessment system

The evaluation of the subject is global in nature and includes the following activities:

1. Laboratory Practices.

Previous preparation for each of the practices, initiative and participation in them will be valued.

A student who fails to attend a session at the scheduled time, unless there is a justified cause, will receive a grade of 0 for that session.

A minimum grade of 5 out of 10 is required to pass the subject.

If the required grade is not passed during the class period, the student will have to take a practical laboratory exam, which will consist of a laboratory test in which the student will demonstrate that they are able to perform any of the sections proposed in the practice scripts.

2. Final Exam

This exam will consist of a written test and will generally consist of problems and theory questions, with an estimated duration of three hours . There will be a written exam at each official exam call.

To pass the subject it is necessary to obtain in the final exam a minimum grade of 4 points out of 10 and a minimum grade of 5 points out of 10 after the following weighting of the two assessment activities: Laboratory Practices: 40%

Final exam: 60%

6. Sustainable Development Goals

7 - Affordable and Clean Energy
12 - Responsible Production and Consumption