

Academic Year: ( 2023 / 2024 )

Review date: 08-06-2023

Department assigned to the subject: Electrical Engineering Department

Coordinating teacher: MORENO LOPEZ DE SAA, MARIA ANGELES

Type: Compulsory ECTS Credits : 6.0

Year : 1 Semester : 2

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

Wind power generation systems.  
 Photovoltaic solar energy.  
 Other renewable energies.

**OBJECTIVES**

- Know the rules and regulations that directly affect the use of renewable energy and its application.
- Understand the requirements for the integration of renewable energies in the electricity markets.
- Understand the fundamentals of the electricity markets, and know the complementary services and the markets that regulate them, for the adequate participation of renewable energies.
- Know and differentiate the different support and remuneration mechanisms of renewable energies, determining their advantages and disadvantages.
- Know the planning of electrical systems taking into account the integration of renewable energies.
- Acquisition of search skills for complex and specific information on regulations and legislation, on issues related to renewable energy.

Upon completion of this course, the student will be able to:

- Participate in the planning of electrical systems taking into account the integration of renewable energies.
- Apply the regulation that determines remuneration and income from renewable generation in Spain and in other neighboring countries.
- Apply to real cases of network analysis tools that are required in renewable energy integration studies.
- Determine the problems of integration of renewable energies, and the solutions to those problems, at an economic and regulatory level.

**DESCRIPTION OF CONTENTS: PROGRAMME**

Energy overview. Basic concepts of electricity markets. Regulated sectors. Retail market  
 General principles of electricity markets. Planning and economic equilibrium  
 Operation of organized electricity markets. Price formation.  
 Congestion managements. Zonal price mechanisms.  
 Secondary markets. Ancillary services.  
 Renewable energies in the electricity markets  
 Participation of renewable energy in electricity markets.  
 Participation under uncertainty  
 Energy subsidies and costs  
 Analysis of costs of renewable energy projects  
 Scenarios for decarbonization of the energy system  
 The operation of the system with renewable energy  
 Renewable energy regulation  
 Participation of renewable energy in electricity markets.

**LEARNING ACTIVITIES AND METHODOLOGY**

Theoretical classes: 18 hours  
 Theoretical practical classes: 30 hours  
 Individual student work: 102 hours

**TEACHING METHODOLOGIES**

Presentation in the classroom by the teacher with the support of computer and audiovisual media, in which the main concepts of the subject are developed and the bibliography is provided to complement

the students' learning.

Resolution of practical cases or problems posed by the teacher individually or in groups.

Preparation of papers and reports individually.

#### ASSESSMENT SYSTEM

Questionnaires and exams throughout the course: 40% of the grade

Individual or group work done during the course: 60% of the grade

<b>% end-of-term-examination:</b>	0
<b>% of continuous assessment (assignments, laboratory, practicals...):</b>	100

#### BASIC BIBLIOGRAPHY

- I.J. Pérez-Arriaga (Ed.) Regulation of the Power Sector, Springer, 2013
- Kirschen & Strbac Fundamentals of Power System Economics, John Wiley & Sons, 2004
- Kirschen & Strbac Fundamentals of power system economics, Wiley, 2019
- Stoft Power System Economics., IEEE Press - Wiley Interscience, 2002
- Wood, Wollenberg & Sheblé Power generation, operation and control, Wiley, 2014