

Academic Year: (2019 / 2020)

Review date: 24-04-2020

Department assigned to the subject: Electrical Engineering Department

Coordinating teacher: USAOLA GARCIA, JULIO

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**COMPETENCES THAT THE STUDENT ACQUIRES WITH THIS COURSE**

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 the students know how to apply the acquired knowledge and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of study

CB8 The students must be able to integrate knowledge and face 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 The students must know how to communicate their conclusions and the knowledge and ultimate reasons that sustain them to specialized and non-specialized audiences in a clear and unambiguous way

CB10 That students have the learning skills that allow them to continue studying in a way that will be largely self-directed or autonomous.

CG2 Acquire adequate knowledge of electrical engineering and areas that have application here.

CG4 Project, calculate and design products, processes, facilities and renewable energy plants.

CG5 Direct, plan and supervise multidisciplinary teams that design or execute renewable energy projects.

CE2 Knowledge of the regulations that directly affect the use of renewable energies worldwide, as well as their origin, validity and application.

CE7 Knowledge of the possibilities and current status of smart grids (Smart Grids) and ability to participate in the design and implementation of the same.

CE13 To know how the operation of the electric networks with renewable energies is carried out.

CE14 Design capacity of production systems, transformation, control and protection of electrical networks.

RESULTS OF LEARNING that the student acquires:

- Capabilities to participate in the planning of electrical systems taking into account the integration of renewable energies.
- Ability to apply the regulation that determines the remuneration and income of renewable generation in Spain and in other countries in our environment.
- Be able to determine the positive and negative points of the different regulations and regulations, as well as the advantages and disadvantages of the different existing support mechanisms.
- Capacity to apply to real cases of network analysis tools that are required in studies of integration of renewable energies.
- Acquisition of search skills for complex and specific information on regulations and legislation, on issues related to renewable energies.
- Ability to determine the problems of integration of renewable energies, and solutions to these problems, at an economic and regulatory level.

DESCRIPTION OF CONTENTS: PROGRAMME

Principles of operation of the electricity markets.
Organized electric markets. Mechanisms of creation of prices.
Nodal and zonal prices.
Ancillary services.
Participation of renewable and non-renewable power plants in electricity markets.
Costs of renewable energies.
Integration costs of renewable energies.
Economic equilibrium of electrical systems with renewable
Mechanisms of support of renewable energies.
Energy scenarios. Planning of electrical systems.
Costs and financing of renewable energy projects

LEARNING ACTIVITIES AND METHODOLOGY

Theoretical class 18 contact hours
Theoretical practical classes 24 hours in person
Individual student work 108 hours of student work

TEACHING METHODOLOGIES

Presentation in class by the teacher with 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, problems, etc.¿ posed by the teacher individually
Preparation of papers and reports individually.

ASSESSMENT SYSTEM

Questionnaires and exams throughout the course: 30% of the grade
Individual or group work done during the course: 40% of the grade
Final exam 30% of the grade

% end-of-term-examination:	30
% of continuous assessment (assignments, laboratory, practicals...):	70

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
- Stoft Power System Economics., IEEE Press - Wiley Interscience, 2002
- Wood, Wollenberg & Sheblé Power generation, operation and control, Wiley, 2014