Electricity Markets

Academic Year: (2019 / 2020) **Review date: 23-05-2019**

Department assigned to the subject: Electrical Engineering Department

Coordinating teacher: USAOLA GARCIA, JULIO

Type: Compulsory ECTS Credits : 6.0

Year : 4 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Electric Power Systems.
AC Electrical Machines

OBJECTIVES

The students should know
- the fundamentals of the f-P regulation as well as the voltage control in power systems.
- the costs of thermal power plants
- the basic principles of electricity markets and the technical and economic aspects of power system operation, including transmission constraints.
- the retail market and the tariffs.
- the grid as a natural monopoly.
- the different ways of participating in the electricity markets.

DESCRIPTION OF CONTENTS: PROGRAMME

* Load-frequency control
  - Load-frequency mechanism
  - Primary regulation.
  - Secondary and tertiary regulation. Load areas.
* Voltage Regulation.
  - Voltage and power transmission capacity.
  - Voltage regulating devices.
* Economic optimization of power systems
  - Operating costs of power plants.
  - Unit commitment.
  - Hydrothermal Coordination. Pumped-storage hydro plants.
* Wholesale electricity markets.
  - Organized electricity markets. Auctions.
  - Congestion management methods.
  - Ancillary services. Reserve markets.
* Participation of generation in the electricity markets
  - Thermal power stations
  - Hydro power stations
  - Other types of generation.
* Transmission and distribution networks.
  - Definitions of transmission and distribution.
  - Economically optimal transport capacity.
  - Other issues: losses and connection fees.
  - Quality of supply.
* The retail market
  - Balance of revenues and costs of the electricity system.
  - Grid tariffs and price of energy.

LEARNING ACTIVITIES AND METHODOLOGY

- Lectures, tutorial sessions with students (3 ECTS credits)
- Computer room exercises and practical problems solved in reduced groups (3 credits ECTS)

ASSESSMENT SYSTEM

1. Final exam (40% of final mark)
2. Partial evaluation (20% of final grade).
3. Projects proposed in class (30% of final grade).
4. Grade of practical work (10% of the final grade)

It is necessary to obtain a minimum grade of 4 out of 10 in the weighted average mark resulting from paragraphs 1 and 2 to approve the subject.
Attendance at practice sessions is mandatory to approve the subject in ordinary call. In an extraordinary call, students who have not passed the internship will have to take a specific exam.
In the extraordinary call the evaluation conditions are the same.

% end-of-term-examination:	40
% of continuous assessment (assigments, laboratory, practicals…):	60

BASIC BIBLIOGRAPHY

- A.G. Expósito (ed.) Análisis y operación de sistemas de energía eléctrica, McGraw-Hill, 2002
- Grainger & Stevenson Análisis de sistemas de energía eléctrica, McGraw Hill, 1995
- Kirschen & Strbac Fundamentals of Power System Economics, John Wiley & Sons, 2004
- Kundur Power system stability and control, Electric Power Research Institute, 1994
- Stoft Power System Economics, IEEE Press - Wiley Interscience, 2002
- Wood, Wollenberg & Sheblé Power generation, operation and control, Wiley, 2014