

# 66339 - Control and protection of power systems with renewable generation

## Syllabus Information

**Academic Year:** 2019/20

**Subject:** 66339 - Control and protection of power systems with renewable generation

**Faculty / School:** 110 -

**Degree:** 535 - Master's in Renewable Energies and Energy Efficiency

**ECTS:** 5.0

**Year:** 1

**Semester:** Second semester

**Subject Type:** Optional

**Module:** ---

## 1.General information

### 1.1.Aims of the course

### 1.2.Context and importance of this course in the degree

### 1.3.Recommendations to take this course

## 2.Learning goals

### 2.1.Competences

### 2.2.Learning goals

### 2.3.Importance of learning goals

## 3.Assessment (1st and 2nd call)

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

## 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. A wide range of teaching and learning tasks are implemented, such as lectures, problem-solving activities, case studies, student active participation, and a technical assignment where the student must demonstrate the knowledge and skills acquired during the course. In the assignment, the students propose a problem, establish the state of the art and solve the technical problem concerning the protection and control of electrical systems references.

### 4.2.Learning tasks

The course includes the following learning tasks:

- **Lectures:** presentation of the technical concepts of the course contents addressed through the teacher's explanations and papers, which will be discussed in class as an exercise of self-learning.
- **Problem-solving activities:** These exercises will be solved by the student (usually in small groups) and discussed among groups for understanding the theoretical concepts presented.
- **Laboratory sessions:** simulation analysis for network studies.
- **Assignment:** focused technology development. In this paper, students will study and analyze the state of art on a particular topic assigned by the teacher and obtain and submit their own conclusions in a particular aspect of the

subject.

### **4.3.Syllabus**

The course will address the following topics:

- Topic I. Transients in power systems
- Topic II. Insulation coordination
- Topic III. Power system protection and analysis of events
- Topic IV. Voltage and frequency control
- Topic V. HVDC

### **4.4.Course planning and calendar**

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 <http://eina.unizar.es> and Moodle <http://moodle.unizar.es>.

### **4.5.Bibliography and recommended resources**

- Coodinación de aislamiento en redes eléctricas de alta tensión. Mc. Graw-Hill, 2008
- Insulation coordination for power systems, A.R. Hileman, Marcel Dekker, 1999.
- Circuitos de parámetros distribuidos. M. García-Gracia, M.A. García García.
- Computer relaying for power systems, A.G. Phadke, J.S. Thorp, John Wiley & Sons, 1994.