Universidad Zaragoza

Year : 2020/21

66336 - Power quality and grid integration

Syllabus Information

Academic Year: 2020/21
Subject: 66336 - Power quality and grid integration
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
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

- To be able to select apropiate sensors and devices in order to perform electrical measurements and tests
- To be able to describe the power quality phenomena, its basic parameters and the current standards
- To analyze power quality measurements and deciding if a given installation fulfill the standards requirements
- To provide possible solutions to real power quality problems
- To planify power quality measurements selecting appropiate instrumentation and their situation based on the description of the installation
- To know the national and internation Grid Codes, specifically the spanish operation procedures (PO 12.3 and PO 12.2)

1.2.Context and importance of this course in the degree

The electrical sector is experiencing a transformation caused by the problems of the current centralized system and the growing of new technologies linked to distributed renewable generation, the storage systems, power electronics and new communication technologies.

In previous courses, students have studied several renewable energies sources, traditional electrical network characteristics and basic power electronic converters. In this course, the power quality problems originated mainly due to power electronics and the requirements for the connection to the grid of renewable sources will be studied.

The course is mainly technical and no other courses of the master are needed as pre-requisite.

1.3.Recommendations to take this course

The student must have knowlege on electricity and electrical networks as well as various cross-disciplinary knowlege. Specifically:

- Advanced knowledge on circuit theory, electrical machines and electrical networks.
- Basic knowledge on power electronics based control systems.
- Capability for autonomous looking up technical and scientific databases.
- Good english level for reading technical documentation

2.Learning goals

2.1.Competences

2.2.Learning goals

In order to pass the course, the student must demonstrate the following results...

- He is able to select apropiate sensors and devices in order to perform electrical measurements and tests

- He is able to describe the power quality phenomena, its basic parameters and the current standards
- He has the capability of analyzing power quality measurements and deciding if a given installation fulfill the standards requirements
- He has the capability of provide possible solutions to real power quality problems
- He is able to planify power quality measurements selecting appropiate instrumentation and their situation based on the description of the installation
- He knows the national and internation Grid Codes, specifically the spanish operation procedures (PO 12.3 and PO 12.2)

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. During **lectures**, the basic concepts of the course will be presented. Short practical exercises will be covered under the teacher's supervision. **Practice sessions** will be used for applying the knowledge acquired in the lectures. These sessions could also be used for problem or case solving or even for lab sessions. Students' **autonomous work** could be of several types:

- Introductory research assignments where the students should analyse information regarding a subject assigned by the teacher and present their own conclusions.
- Assignments consisting on the broadening of some of the course topics that could not be covered with enough detail in regular classes.
- Practical case solving tasks where the student show the skills acquired in the course.

4.2.Learning tasks

The course includes the following learning tasks:

- A01 Lectures (25 hours). Presentation of theoretical contents by a faculty or by external experts to all students enrolled in the course. Although it is not a mandatory activity, regular attendance is highly recommended.
- A02 Problem and case solving (13 hours). Solve practical problems and exercises with all the students. Although it is not a mandatory activity, regular attendance is highly recommended.
- A03 Laboratory sessions (12 hours). Students will work actively in groups to solve practical exercises.
- A06 Guided assignments (20 hours). Students will complete assignments, problems and exercises related to concepts seen in laboratory sessions and lectures.
- A07 Autonomous work (50 hours). Students are expected to spend about 50 hours to study theory, solve problems and prepare lab sessions
- A08 Assessment (5 hours).

The indicated hours are for guidance and will be adjusted depending on the academic calendar.
At the beginning of the course, lecturers will communicate the schedule of practice sessions, which will be set according to the syllabus and the availability of laboratories and computer rooms.

4.3.Syllabus

The course will address the following topics:

1. Introduction, classification and types of sensors
2. Measurement transformers
3. Current measurement
4. Power quality introduction
5. Frequency variations
6. Voltage dips and short interruptions
7. Voltage fluctuations and flicker
8. Harmonics
9. Harmonic analysis
10. Power quality monitorization

11. Grid integration of renewable sources

Annexes

- Per unit system
- Sequence networks

4.4.Course planning and calendar

Further information concerning the timetable, classroom, assessment dates and other details regarding this course, will be provided on the first day of class or please refer to the course webpage http://moodle2.unizar.es

The course is taught in the second semester.

The first day of the course, the teacher will provide to the students all the relevant information:

- Methodology
- Teaching sessions
- Practical sesions
- Individual work
- Final exam
- Deadlines

4.5.Bibliography and recommended resources