IoT-based Energy Services

Academic Year: (2020 / 2021) **Review date: 02-07-2020**

Department assigned to the subject: Electrical Engineering Department

Coordinating teacher: CASTRONUOVO , EDGARDO DANIEL

Type: Compulsory ECTS Credits : 3.0

Year : 1 Semester : 1

OBJECTIVES

Basic skills

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 students know how to apply the knowledge acquired and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of study.
CB8 That students can 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 That the students know to communicate their conclusions and the knowledge and last reasons that sustain them to specialized and non-specialized public in a clear and unambiguous way.

General skills

CG1 Ability to identify, define and formulate the problems to solve related to IOT applications. This capacity includes the simultaneous assessment of all the factors at stake, not only technical, but also environmental and civil liability.
CG5 Capacity of public communication of the concepts, developments and results, related to activities in IOT, adapted to the profile of the audience.
CG6 Ability to apply the knowledge acquired and solve problems in new or unfamiliar environments within broader and multidisciplinary contexts, with the ability to integrate knowledge.

Specific competences

CE3 Ability to identify security risks in communications in IoT environments and identify appropriate communication protocols to mitigate the identified risks.
CE4 Ability to design and implement communications networks for IoT environments.
CE5 Ability to design, develop, manage and evaluate security assurance mechanisms in the treatment and access to information in computationally limited devices and in IoT networks.
CE6 Ability to apply mathematical, statistical and artificial intelligence methods to model, design and develop applications, services and intelligent systems in the field of IoT.
CE7 Ability to apply different methods of treatment and massive support of dynamic data in energy facilities.
CE8 Ability to design, plan and control industrial applications through IoT technologies.
CE9 Programming and simulation skills of perception and control systems at various levels (high-intermediate-low): OpenCV, ROS, Gazebo, etc.
CE11 Ability to design and control the latest generation wireless networks in IoT applications.
CE12 Ability to apply device communication, both among them and globally, in the IoT environment.

LEARNING RESULTS

The learning outcomes that students should have are:
- Analysis and synthesis capacity for advanced systems control: methods of identification, systems with learning, etc.
- Design capacity of a low and medium complexity control system with its ability to interact with the user.
- Analysis skills and massive data processing in digital energy networks: operation and security.
- Know the communication protocols for IoT networks.
- Know the security mechanisms for IoT communications.
- Ability to design a communication solution for IoT by selecting and adapting the communication protocols that are most suitable for the use case.

- Know and apply the techniques of automatic learning for IoT.
- Ability to process the usual errors in the data to be able to use them.

DESCRIPTION OF CONTENTS: PROGRAMME

Dear student:

In this subject, the changes happened and to be made in the electrical system are analysed, in terms of the communication challenges required by the incorporation of electric vehicles, storage and renewable generation.

It is structured in 4 main areas:

1. The electrical system, main components and their interrelation between elements.
1.1. Structure of generation, transmission and distribution in the electrical system.
1.2. Sources of generation in Spain and Europe.
1.3. Main characteristics of the transmission and distribution systems.

2. The electric vehicle.
2.1. Main characteristics, in function of their interaction to the electrical system.
2.2. Optimization of charge periods, depending on own benefit and efficiency of the system.

3. Electrical storage.
3.1. Types of electrical storage.
3.2. Interaction with other producers and the electrical system.

4. Renewable generation.
4.1. Main characteristics of not fully controllable renewable generation.
4.2. Interaction between renewable generation, storage and electrical system.
4.3. Optimization of the operation.

In the course, 2 laboratory activities are carried out, in 3 laboratory seasons:

* Optimization of the charging of an electric vehicle.
* Optimization of renewable generation and its interaction with storage.

LEARNING ACTIVITIES AND METHODOLOGY

TRAINING ACTIVITIES OF THE STUDY PLAN REFERRED TO MATTERS
AF1 Theoretical class
AF4 Laboratory practices
AF6 Group work
AF7 Individual student work
AF8 Partial and final exams

Code Activity	No. Total hours	No. Presential hours	% Presence Student
AF1	52	52	100
AF4	32	32	100
AF6	80	0	0
AF7	128	0	0
AF8	8	8	100
TOTAL	300	92	31%

TEACHING METHODOLOGIES
EDUCATIONAL TRAINING METHODOLOGIES OF PLAN REFERRED TO SUBJECTS
MD1 Exhibitions in the teacher's class 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.
MD2 Critical reading of texts recommended by the teacher of the subject: Press articles, reports, manuals and / or academic articles, either for further discussion in class, or to expand and consolidate the knowledge of the subject.
MD3 Resolution of practical cases, problems, etc. posed by the teacher individually or in groups.
MD4 Exhibition and discussion in class, under the teacher's moderation of topics related to the content of the subject, as well as case studies
MD5 Preparation of papers and reports individually or in groups.

ASSESSMENT SYSTEM

100% continuous evaluation, based on works, class participation and assessment tests of skills and knowledge.

% end-of-term-examination:	0
% of continuous assessment (assigments, laboratory, practicals…):	100

BASIC BIBLIOGRAPHY

- A. Gómez-Expósito, J.L. Martínez Ramos, J.A. Rosendo Macias, E. Romero Ramos, J.M. Riquelme Santos Sistemas eléctricos de potencia, problemas y ejercicios resueltos, Prentice Hall, 2003
- F. Barrero Sistemas de Energía Eléctrica, Thomson, 2004
- J.J. Grainger y W.D. Stevenson Power Sys. Analysis, McGraw Hill, 2018