ESCUELA TÉCNICA SUPERIOR DE INGENIERÍA

DIE-OPT-612 ICT and Big Data in Power Systems

SEMESTER: Fall

CREDITS: 3 ECTS (2 hrs. per week)

LANGUAGE: English

DEGREES: MII, MIT, SAPIENS program

Course overview

In the last decades the energy systems -including different carriers such as power, gas, heat and water systems- are progressively increasing their monitoring degree, thanks to the communication and sensor improvements. In this line, there is a need for power system engineers to have a clear understanding of the communication layer required for the operation of future power energy networks. Moreover, the massive amount of information stored will certainly create new functionalities and business models, but requires analysis strategies to squish value for the system. In this course, these topics will be addressed, balancing theoretical lectures and laboratory sessions.

Prerequisites

A general background of power systems is required.

Course contents

1) **Power layer**
   1. Introduction to future energy networks management.
   2. Sensors in networks, generation facilities, and consumers (Smart meters).
   3. Functionalities bringing value (protection, automation and control, billing, state estimation, etc.).
2) **Communication layer**
   4. Distribution network: from secondary to primary substation, interoperability standards in the field (IEC 61850 and IEC 61970).
   5. Last mile network: wired (PLC) and wireless (wMBUS) communications, smart meter to concentrator (PRIME, G3, meters&more), etc.
   6. Home network: appliance communications, energy box, zigbee, …
   7. Case study.
3) **Smart grids application layer**
   8. Utility based control system (SCADA, DMS, EMS, AMI, DR control system, etc.).
   9. Smart metering principles and deployment.
   10. Big Data management principles.

11. Big Data in Energy and Utilities.
12. Cyber Security in power systems.

Textbooks

- "Telecommunication Networks for the Smart Grid", Sendin et al., Artech House, 2016.
- "Communication and Control in Electric Power Systems: Applications of Parallel and Distributed Processing" Mohammad Shahidehpour, Yaoyu Wang, Wiley-IEEE Press, 2003.
- "Communication Networks for Smart Grids", Budka et al., Springer, 2014.
- "The Future of the Electric Grid". An Interdisciplinary MIT study, 2011.
- Notes for the master lecture and relevant reports

Grading

The fifinal grade grade is obtained as follows:

- 40% Section tests
- 20% Group case studies
- 40% Final group work

A grade of at least 5 is required in each part.

PLANNING FOR THE ACADEMIC COURSE 2017-2018

Room: 407

Timing: Tuesdays, 17.00-19.05

Students: tbc

Session	Lecturer	Date
1. Introduction to future energy networks management.	Pablo Frías	5-sep
2. Sensors in networks, generation facilities, and consumers (Smart meters).	Pablo Frías	12-sep
3. Functionalities bringing value (protection, automation and control, billing, state estimation, etc.).	Pablo Frías	19-sep
4. Last mile network: energy utility perspective	M.A. Sánchez	26-sep
5. Last mile network: theoretical principles.	Javier Matanza	3-oct
6. Home network: appliance communications, energy box, zigbee, standards, …	Carlos Rodríguez	10-oct
7. Practical case study on communications.	Javier Matanza	17-oct
8. Utility based control system (SCADA, DMS, EMS, AMI, DR control system, etc.).	David Trebolle	24-oct
9. Smart metering principles and deployment	Pablo Frías	7-nov
10. Big Data management principles.	Luis Reina	14-nov
11. Big Data in Energy Systems.	Eugenio Sánchez	21-nov
12. Cyber Security in power systems.	Javier Jarauta	28-nov
13. Summary session and exam	Pablo Frías	5-dic