Dynamical analysis and control of electrical systems

Academic Year: (2019 / 2020) **Review date: 08/05/2020 20:39:37**

Department assigned to the subject: Electrical Engineering Department

Coordinating teacher: LEDESMA LARREA, PABLO

Type: Compulsory ECTS Credits : 6.0

Year : 1 Semester : 2

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Basic theory of electric circuits.

OBJECTIVES

Generally, the student will be able to:
- Analyze and design electric power systems.
- Analyze the dynamic response of a power system.
- Perform power system dynamic studies similar to those carried out by electric companies.

More specifically, the student will adquire:

Capability to recognize the agents of a power system involved in each control system.
Ability to select the appropriate devices to solve voltage problems in an electric grid and to explain how they work.
Capability to recognize the phenomena that can result in a voltage collapse.
Capability to explain in detail the primary, secondary and tertiary frequency control systems.
Capability to explain the load shedding and other load disconnection schemes in the peninsular power system.
Ability to foresee the behavior of the frequency control systems after different incidents in the power grid.
Ability to select a power system analysis software tool depending on the type of study.
Capability to explain the main phenomena that rule the electro-mechanical oscillations in a power system after a severe perturbation.
Ability to analyze the results of a dynamic simulation such as the performed by the transmission system operators.

DESCRIPTION OF CONTENTS: PROGRAMME

1 Power system control and regulatory frame

2 Voltage control
- Reactive power control and voltage control
- Capacitors and inductors
- Synchronous compensators
- Static VAR compensators (SVCs)
- Static synchronous compensator (STATCOM)
- Tap change transformers
- Excitation systems
- Voltage control in the Spanish regulation
- Voltage stability

3 Frequency control
- Frequency control basics
- Primary control
- Secondary control

- Other mechanisms: terciery control, time control, reserves
- Load shedding and interruptilibity service

4 Transient stability
- Definition of transient stability
- Equal area criterion
- Power system dynamic response simulation

5 What will be power systems like in the future?

LEARNING ACTIVITIES AND METHODOLOGY

- Theory sessions in the classroom.

- Solution of practical problems.

- Reading and discussion of technical documents related to the course.

- Oral presentation of one topic related to power systems.

- Practical sessions in a computer laboratory

- Tutory sessions

ASSESSMENT SYSTEM

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

Continuous Assessment:
- 3 weighted midterm exams.
- Oral presentation in class, that may count up to 10% of the continuous assessment.
Whoever obtains 6/10 or more in the continuous assessment passes the course without having to attend the final exam.

Ordinary call:
- Continuous assessment 40%
- Final exam 60%

Extraordinary call:
- Continuous assessment 50%
- Final exam 50%
or
- Final exam 100%

BASIC BIBLIOGRAPHY

- Kundur Power System Stability and Control, McGraw-Hill.

ADDITIONAL BIBLIOGRAPHY

- Kwatny, Harry G. ; Miu-Miller, Karen Power System Dynamics and Control, Springer, 2016

- N. V. Ramana Power System Operation and Control, Pearson, 2010

- Paul M. Anderson A.A Fouad Power system control and stability, Institute of Electrical and Electronics Engineers , 1977

- Pota, Hemanshu Roy The Essentials of Power System Dynamics and Control, Springer, 2018

BASIC ELECTRONIC RESOURCES

- European Network of Transmission System Operators for Electricity . ENTSOE web page: http://www.entsoe.eu

- Red Eléctrica de España . Página web de Red Eléctrica de España: http://www.ree.es