Electrical equipment and systems

Academic Year: (2023 / 2024) **Review date: 30-05-2022**

Department assigned to the subject: Electrical Engineering Department

Coordinating teacher: MORENO LOPEZ DE SAA, MARIA ANGELES

Type: Electives ECTS Credits : 6.0

Year : 1 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Students should have basic knowlegde about analysis of linear single-phase and balanced three-phase ac circuits.

OBJECTIVES

Students should be able to:
CG2 - Know the basic concepts of Electrical Engineering and related areas.
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 - Know how to apply the acquired knowledge and their ability to solve problems in new or little-known environments within broader (or multidisciplinary) contexts related to their area of study
CB8 - Integrate knowledge and facing 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 - Know how to communicate their conclusions and the knowledge and ultimate reasons that support them to specialized and non-specialized audiences in a clear and unambiguous way
CB10 - Possess the learning skills that allow them to continue studying in a way that will be largely self-directed or autonomous.
And more specifically:
- Know and understand the basic structure of the power systems, their elements and their functions, representing these correctly in an electrical diagram in both steady state and transient, and interpret their characteristic parameters and their assigned values.
- Understand the basic operating principle of rotating electrical machines (synchronous and asynchronous), find the equivalent circuit in steady state and the torque-speed characteristic curve.
- Interpret the meaning of unit magnitudes in a power system and perform simple analysis of electrical systems.
- Perform calculations specified in the rules of power-flow, short-circuit and transient stability analysis in connecting renewable generation systems.
- Understand and analyze the operation of the synchronous machine and the transformer as a control element for voltage or power flows.
- Understand the fundamental concepts related to the frequency and voltage control in power systems.
- Describe the operation of a simulation tool for power systems and determine the values of the electrical quantities using the tool.

DESCRIPTION OF CONTENTS: PROGRAMME

Part 1. Introduction
- Basics of Electrical Power Engineering
- Introduction to the electric power systems.

Part 2. Elements of power system.
- Transmission lines.
- Transformers.
- Asynchronous machines.
- Synchronous machines.

Part 3. Power systems analysis.
- Per-unit quantities.
- Load-flow solutions and control.
- Symmetrical three-phase faults.

- Power system stability.

Part 4. Power system operation.
- Frequency-power control.
- Voltage control.

LEARNING ACTIVITIES AND METHODOLOGY

- Magisterial classes, tutorship and personal work oriented to the acquisition of theoretical knowledge.
- Problems solution classes, computer sessions, tutorship and personal work oriented to the acquisition of practical skills.

ASSESSMENT SYSTEM

ORDINARY CALL:

Option 1: 100% Continuous evaluation.
It is based in classroom and home exercices, weekly partial tests and personal work with commercial solftware for power system analysis. They will test the acquisition of basic skills and concepts by the student.

- Weekly partial tests (40%)
- Personal work with power system analysis software (20%)
- Exercices and numerical problems (40%)

Option 2: Final exam (80%) + Personal work with power system analysis software (20%).
This option is designed for those students who can not attend classes regularly.

EXTRAORDINARY CALL: 100% Final exam.

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

BASIC BIBLIOGRAPHY

- Barrero Sistemas de energía eléctrica, Paraninfo, 2004
- Stevenson Elements of Power Systems Analysis, McGraw-Hill, 1989
- Wood & Wollenberg Power generation, operation and control, John Wiley & Sons, 1996

ADDITIONAL BIBLIOGRAPHY

- Fraile Máquinas Eléctricas, 6ª ed, McGraw-Hill, 2008