Electrical power engineering fundamentals

Academic Year: (2019 / 2020) **Review date: 19-06-2019**

Department assigned to the subject: Department of Electrical Engineering

Coordinating teacher: ROBLES MUÑOZ, GUILLERMO

Type: Compulsory ECTS Credits : 6.0

Year : 2 Semester : 1

STUDENTS ARE EXPECTED TO HAVE COMPLETED

All first-year subjects. Among them, Calculus I, Calculus II and Physics II are of utmost importance.

COMPETENCES AND SKILLS THAT WILL BE ACQUIRED AND LEARNING RESULTS.

After the student has passed this subject, he/she will be able to:
- Describe the basic aspects of the structure and operation of electric circuits and power systems (single- and three-phase), employing a proper wording and terminology, in terms of their fundamental variables: voltages, currents, power, impedances, and power factor.
- Analyze whatever electrical circuit in steady-state, calculating voltages, currents and power in each element, using systematic methods (nodal analysis, mesh analysis) as well as non-systematic ones (circuit reduction, grouping of elements, etc). Also he/she will be able to describe the behaviour of any dipole by substituting the balance of the circuit by its Thevenin or Norton equivalent.
- Perform this type of analysis on any a.c. circuit at constant frequency, representing the corresponding magnitudes by their associate complex phasors.
- Correctly choose and operate electrical instruments to carry out experimental measurements on a real circuit.
- Use the single-phase equivalent to analyze a simple balanced three-phase circuit, and correctly apply reactive power compensation techniques by insertion of banks of capacitors.
- Finally, the student will be able to analyze the transient response in first order (RC or RL) circuits.

DESCRIPTION OF CONTENTS: PROGRAMME

1. Introduction
1.1. General concepts
1.2. Kirchhoff's laws

2. Direct current circuits
2.1. Resistances and dependent and independent generators
2.2. Associations in series and parallel
2.3. Methods of meshes and nodes
2.4. Thévenin theorem

3. Altern current circuits
3.1. Inductances (coils) and capacitors
3.2. Waves and phasors
3.3. Impedance.
3.4. Circuits rseolutions in frequency domain
3.5. Power in AC circuits

4. Three-phase systems
4.1. General concepts
4.2. Line-to-neutral and line-to-line magnitudes
4.3. Single phase equivalent
4.4. Three phase power and reactive power compensation

5. First-order transient circuits
5.1 RC transient circuits
5.2 RL transient circuits

LEARNING ACTIVITIES AND METHODOLOGY

Basic theoretical concepts that students need learning to understand the subject will be explained in

master classes. Within the master class will be solved simple exercises that will help settling theory explained in each session. To make optimum use of the master class, it woulll be advisable to know which topics will be presented consulting on schedule. Likewise, the students should have worked on those topics before classes.

Small classes in which the nearest student learning track will be done. These sessions will assess the skills acquired during the previous lectures and weekly work of students. Work, exercises and small daily examinations may be proposed. Along the course, three tests will be done on the days fixed in the schedule.

There will be three practice sessions of laboratory in which the implementation of theoretical concepts will be worked.

There are few specific times for tutorials and consultations of students. At the discretion of the teacher, tutoring outside that time period may be fixed if a student requests it.

ASSESSMENT SYSTEM

The evaluation of the subject can be through a scheme of continuous assessment and final examination.

In the continuous assessment scheme:

a) in the regular call:

Option 1:
- Continuous evaluation (45% of the total mark). 90% of this grade is obtained by weighting three exercises: first exercise (DC circuits) 25%, second exercise (AC circuits) 30%, third one (3-phase circuits and transients) 35%. The left 10% will be obtained from the laboratory mark. The development of the lab sessions is compulsory for all students.

- A final exam (55% of the total mark) made up of numerical resolution of 3-4 problems of circuits analysis in such a way that all the topics of the subject are covered with a weight of 50% of the final grade and a part relating to the activities developed in the laboratory practices which have a weight of 5%.

Option 2:
In any case, all those who have passed lab sesions and have completed their three intermediate tests, having obtained a minimum score of 5 points in the calculation of the average partial grade, are exempt of the final examination included in option 1. A note minimum of 2,5 in each partial exam is required to be able to approve.

EXTRAORDINARY CALL: 2 options
- 100 % of the total record will come from a final exam consisting in solving 3 - 5 numerical problems of circuit analysis, covering the whole content of the course (this amounts to 90% of the total), plus a short test on the activities carried out during the lab sessions (remaining 10%).
If the student has not passed the lab sessions, he must pass a practical lab exam in order to be able to pass the subject.
- Final exam + continuous evaluation: same than in the ordinary call.

% end-of-term-examination:	55
% of continuous assessment (assigments, laboratory, practicals…):	45

BASIC BIBLIOGRAPHY

- Bruce M. Carlsson Teoría de Circuitos, Paraninfo, 2000
- Guillermo Robles Problemas resueltos de fundamentos de ingeniería eléctrica, PARANINFO, 2015
- Jesús Fraile Mora Electromagnetismo y Circuito Eléctricos, Mc. Graw Hill, 1995
- Julio Usaola, Mª Ángeles Moreno Circuitos eléctricos: Problemas y ejercicios resueltos, Pearson Educación, 2002

ADDITIONAL BIBLIOGRAPHY

- Antonio Conejo Navarro Circuitos eléctricos para la Ingeniería, McGraw-Hill, 2004
- Antonio Gómez Expósito Teoría de Circuitos. Ejercicios de autoevaluación, Thomson, 2005
- J. Fernández Moreno Teoría de Circuitos. Teoría y problemas resueltos, Paraninfo, 2011