Electrical power engineering fundamentals

Academic Year: (2020 / 2021) **Review date: 02-09-2020**

Department assigned to the subject: Electrical Engineering Department

Coordinating teacher: ALONSO-MARTINEZ DE LAS MORENAS, JAIME

Type: Compulsory ECTS Credits : 6.0

Year : 2 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

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

OBJECTIVES

By the end of this content area, students will be able to have:
1. A systematic understanding of the key aspects and concepts of electrical engineering;
2. Awareness of the wider multidisciplinary context of engineering.
3. The ability to apply their knowledge and understanding to identify, formulate and solve electrical engineering problems using established methods;
4. The ability to design and conduct appropriate experiments, interpret the data and draw conclusions;
5. Workshop and laboratory skills.
6. The ability to combine theory and practice to solve electrical engineering problems.

DESCRIPTION OF CONTENTS: PROGRAMME

Introduction to the Electric Power Engineering
Ideal- and real elements of circuits: resistance, inductance, capacitance, coupled inductances, voltage- and current sources.
Kirchhoff's laws.
Grouping of elements. Voltage and current divider.
Mesh and nodal analysis of linear circuits
Superposition principle. Thevenin's and Norton's theorems.
Symbolic computation by means of complex phasors.
Analysis of a.c. circuits
Balanced three-phase circuits
Fundamentals of electric power systems

LEARNING ACTIVITIES AND METHODOLOGY

This subject has a twofold objective. On one side, the spreading of a basic electrical engineering culture, including the proper use of the technical language and vocabulary used to describe electric circuits and systems. On the other hand, the explanation of theoretical foundations and practical methods of analyzing linear, lumped-parameters, dc and ac circuits.

Therefore, the methodology is a mix of theoretical lectures, that essentially involve a thorough and systematic application of Kirchhoff's laws, and practical, problem solving oriented activities. Simple problems will be solved manually, more complex ones will require the use of computer tools.

Classroom activities will be completed with three lab sessions, with a duration of two hours each, on measurements and safety rules, dc circuits, ac circuits and 3-phase circuits. This year the lab sessions will be computer-based, using the simulation software PSIM.

The use of PSIM will also be extended to the theory and problem solving sessions, as a visual tool that provides inmediate feedback on key concepts, and as a tool for checking problem results.

ASSESSMENT SYSTEM

THINGS TO DO DURING THE COURSE REGARDING GRADES:

- There are 3 lab sessions during the course. Lab sessions are optional, but everybody has to pass an exam on the lab sessions at the end of the semester. Those who don't pass this exam won't be able to

pass the course before the extraordinary call. You won't be able to go to the ordinary call.
- The students will take 3 partial exams during the course. Their continuous evaluation grade will be the average of those exams.

There are 3 opportunities to pass the course:

1) WITHOUT GOING TO THE FINAL EXAM:

If the student has passed the lab exam AND has obtained more than 3/10 in all three partial exams, AND the average of the three partial exams is 5 or more, the student does not need to go to the ordinary call, and the grade will be the continuous evaluation grade.

2) ORDINARY CALL: CONTINUOUS EVALUATION+FINAL EXAM:

The ordinary call exam will consist in solving 3 - 9 problems of circuit analysis, covering the whole content of the course. Questions on lab sessions can be included.
Final grade calculation:
- A minimum grade of 5/10 is required to pass.
- If the student has passed the lab exam and has obtained a an average of more than 2/10 in any of the three main parts of the exam (DC, AC and Three-phase), the final grade will be 40% continuous evaluation and 60% exam grade.
- If the student has NOT passed the lab exam or has obtained an average of less than 2/10 in any of the three main parts of the exam (DC, AC and Three-phase), the final grade is computed just like in the previous point, but with a maximum of 4/10. Therefore the student will not be able to pass.

3) EXTRAORDINARY CALL: 2 options

- Only an exam: The exam will consist in solving 3 - 9 problems of circuit analysis, covering the three main parts of the subject: DC, AC and Three-phase. Questions on lab sessions can be included. If the student has obtained an average of less than 2/10 in any of the three main parts of the exam (DC, AC and Three-phase), the final grade will be a maximum of 4/10. A minimum of 5/10 is required to pass.

- Exam + continuous evaluation: same as in the ordinary call.

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

BASIC BIBLIOGRAPHY

- James William Nilsson Electric Circuits, Pearson, 2015
- Jesús Fraile Mora Electromagnetismo y Circuitos Eléctricos, McGraw-Hill, 2005
- Jesús Fraile More Circuitos Eléctricos, Pearson, 2012

ADDITIONAL BIBLIOGRAPHY

- Antonio Gómez Expósito Fundamentos de Teoría de Circuitos, Thomson, 2007
- Antonio Gómez Expósito Teoría de Circuitos - Ejercicios de Autoevaluación, Thomson, 2005

BASIC ELECTRONIC RESOURCES

- RG Powell . Introduction to Electric Circuits: http://www.sciencedirect.com/science/book/9780340631980

- William H. Hayt & Jack E. Kemmerly . Engineering Circuit Analysis: https://archive.org/details/EngineeringCircuitAnalysis_280