

Academic Year: ( 2023 / 2024 )

Review date: 26-04-2023

Department assigned to the subject: Electrical Engineering Department

Coordinating teacher: ARREDONDO RODRÍGUEZ, FRANCISCO

Type: Compulsory ECTS Credits : 6.0

Year : 1 Semester : 2

**REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)**

All first-semester courses. Among them, Calculus I and Linear Algebra are of utmost importance.

**OBJECTIVES**

By the end of this course, students will be able to have:

1. A systematic understanding of the key aspects and concepts of electrical power 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**

1. Introduction
  - 1.1. General concepts
  - 1.2. Kirchhoff's mottos
2. DC circuits
  - 2.1. Dependent and independent resistors and generators
  - 2.2. Series and parallel associations
  - 2.3. Mesh and knot method
  - 2.4. Thévenin's theorem and superposition principle
3. Alternating current circuits
  - 3.1. Coils and Capacitors
  - 3.2. Waves and phasors
  - 3.3. Impedance
  - 3.4. Circuit resolution in the frequency domain
  - 3.5. AC power
4. Balanced three-phase systems
  - 4.1. General concepts
  - 4.2. Line and phase magnitudes
  - 4.3. Single phase equivalent
  - 4.4. Three-phase power and reactive compensation
5. First-order transients
  - 5.1 RC transients
  - 5.2 RL transients

**LEARNING ACTIVITIES AND METHODOLOGY**

This course has two weekly sessions alternating a theoretical session and a practical one:

**THEORETICAL SESSIONS**

Theoretical concepts will be explained during lectures based on slide presentations available on Aula Global together with the solution of small problems on the blackboard. Additional multimedia material could be provided during the course.

**PRACTICAL SESSIONS**

The teacher will solve problems using the knowledge already presented in the previous lectures and will propose additional exercises to the students to be solved during the class.

## LABORATORY SESSIONS

Attendance is mandatory. There are three lab sessions:

- Basic concepts and DC systems
- AC systems
- Three-phase AC systems

Safety in the lab is a major issue. No one should turn on any devices without the supervision of the laboratory teacher. Personal and partner's safety are the most important safety issues. Equipment safety is also important. Safety rules and indications from the teacher must always be followed. Breaking this rule may cause expulsion from the course.

There is a lab report for every session. In this report, there is a part to be completed before the lab session. Completion of this part is mandatory to get into the lab. All reports will be checked and validated. Those who fail in this part won't be allowed in the lab.

The lab exam consists of short exercises about different aspects learnt during the lab sessions, i.e. how to connect a voltmeter/ammeter, properly analyzing a waveform in an oscilloscope, Delta/Wye connection of three-phase loads and so on. The evaluation of the laboratory part will be the grade of the lab exam. The lab reports will not be graded.

## GENERAL INFORMATION

- Theory: Francisco Arredondo, 1.3D12, 91 624 6230, farredon@ing.uc3m.es
- Tutorial sessions: check professor's timetable on Aula Global. The tutorial session must be previously requested via e-mail. Tutorial sessions will only be attended within office hours.

## ASSESSMENT SYSTEM

THINGS TO DO DURING THE COURSE REGARDING GRADES:

-->Project.

-->There are 3 mandatory lab sessions during the course. Lab reports will not be graded, but it will be scheduled a lab exam at the end of the semester.

-->The students will take 3 midterm exams during the course.

There are 3 opportunities to pass the course:

### 1) WITHOUT GOING TO THE FINAL EXAM:

If the student has obtained at least 5/10 in the continuous evaluation grade AND has obtained at least 4/10 in all three partial exams, AND the average of the three midterm exams is 5/10 or more, the student does not need to go to the ordinary call, and the course grade will be the continuous evaluation grade.

### 2) ORDINARY CALL: CONTINUOUS EVALUATION 40%+FINAL EXAM 60%:

The ordinary call exam will consist of solving several problems of circuit analysis. Questions on lab sessions may be included.

Final course grade calculation:

-->A minimum grade of 5/10 in the ordinary exam is required to pass.

-->The final grade will be 40% continuous evaluation grade and 60% exam grade.

-->If the student gets less than 2.5/10 in any of the FINAL exam exercises, the maximum final grade is 4/10. This requirement does not apply to the midterm exams, only to the final exam.

### 3) EXTRAORDINARY CALL

-->The extraordinary call exam will have 2-4 exercises. Questions on lab sessions can be included.

-->A minimum grade of 5/10 is required to pass.

-->If the student gets less than 2.5/10 in any of the extraordinary exam exercises, the maximum final

grade is 4/10.

-->The final grade will be the highest between 40% continuous evaluation grade + 60% exam grade OR 100% exam grade.

<b>% end-of-term-examination:</b>	60
<b>% of continuous assessment (assignments, laboratory, practicals...):</b>	40

#### BASIC BIBLIOGRAPHY

- Guillermo Robles Problemas resueltos de Fundamentos de Ingeniería Eléctrica, Paraninfo.
- James William Nilsson Electric Circuits, Pearson, 2015

#### ADDITIONAL BIBLIOGRAPHY

- Jesús Fraile Mora Circuitos eléctricos, Pearson.
- Jesús Fraile Mora Problemas de circuitos eléctricos, Pearson.
- Julio Usaola y A. Moreno Circuitos eléctricos. Problemas y ejercicios resueltos, Prentice Hall.

#### BASIC ELECTRONIC RESOURCES

- Belén García y Francisco Arredondo . Electrical Power Engineering Fundamentals: <http://ocw.uc3m.es/ingenieria-electrica/electrical-power-engineering-fundamentals>