Universidad Zaragoza

Academic Year/course: 2021/22

29715 - Basic principles of electrical technology

Syllabus Information

Academic Year: 2021/22
Subject: 29715 - Basic principles of electrical technology
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
Degree: 434 - Bachelor's Degree in Mechanical Engineering
ECTS: 6.0
Year: 2
Semester: First semester
Subject Type: Compulsory
Module:

1. General information

1.1. Aims of the course

The subject ?Fundamentals of Electrical Engineering? and its expected results meet the following approaches and objectives:

The course is intended to the acquisition of basic knowledge about the use of electric energy in its various forms (DC and AC current), and the need and use of electrical machines in the processes of energy transformation.

1.2. Context and importance of this course in the degree

?Fundamentals of Electrical Engineering? is part of the industrial sector subjects and it is taught in the 2nd academic year in the Mechanical Engineering degree. In order to attend it, knowledge acquired in ?Mathematics? and ?Physics? subjects (1st academic year) are required. The subject explains important electrical bases related to the ?Automatic Systems? subject, belonging to the 2nd semester of the 3rd academic year of the degree. It also presents contents that are important for the ?Fundamentals of Electronics? subject, belonging to the 3rd academic year of the degree.

1.3. Recommendations to take this course

To take the subject of "Fundamentals of Electrical Engineering", basic knowledge of mathematics and general physics are essential. It is advisable to have taken the subjects of Mathematics I and II , and Physics I and II , which are taught in first year in the Degree in Mecanical Engineering.

Continuous work is strongly recommended to pass the course.

2. Learning goals

2.1. Competences

Bypassing this subject, students will be more competent to ...

C04- Solve problems and make decisions with initiative, creativity and critical thinking.

C05- Communicate and transmit knowledge, skills and abilities.

C21- Know and use principles of electrical circuits and electrical machines

2.2. Learning goals

It is intended that the student is able to:

- ? Analyze and solve basic electrical DC and AC circuits, containing passive elements (resistors, inductors and capacitors)
- ? Know the management of major electric measuring instruments (multimeters, power meters, oscilloscopes, etc)
- ? Select an electrical machine according to the requirements on energy transformation
- ? Perform the electrical assembly of a circuit or connection with an electrical machine

2.3. Importance of learning goals

The successful completion of the subject aims to complete the scientific and technical training student and set the basic electrical knowledge needed to develop job skills associated with the Degree in Mechanical Engineering.

With this intention, it is intended that the student is able to:

- Know the basics of circuit theory and electrical machines
- Understand the principles of circuit theory and electrical machines and has the ability to apply them to simple problems analysis of electrical circuits and electrical machines

3. Assessment (1st and 2nd call)

3.1. Assessment tasks (description of tasks, marking system and assessment criteria)

The student must demonstrate that he/she has achieved the intended learning outcomes through the following evaluation activities:

Option 1: To encourage the ongoing work of the student, it can be applied an overall assessment, by means of the evaluation of the following activities:

- Laboratory sessions (15% of the final mark): It is required to attend all the sessions. In order to evaluate each session, the student will present a final report, by filling in a questionnaire before the end of the session. To pass the course is necessary to obtain a minimum score of 5.
- Tutorized works/cases (15% of the final mark): Throughout the semester, the resolution of practical cases, similar to those resolved in the contact sessions, will be proposed. The exercises will be reviewed personally to each student, and content, understanding, and presentation will be evaluated.
- Evaluation test (20% of the final mark): **a midterm exam** (multiple-choice questions and problem-solving questions) of 1,5 hours (approximately), is performed. **This midterm exam** cover topics related to units 1 to 6.
- Final written exam (50% of the final mark). The final exam consists of a written exam to be performed at the end of the course. It consists of multiple-choice questions (theoretical exam) and problem-solving questions (problem exam), which evaluates all the knowledge seen in lessons. Each one of the parts represents 50% of the exam, being necessary to obtain a minimum score of 3.5 in each part (theoretical and problem exam). To pass the course is necessary to obtain a minimum score of 4.0 on the final exam.

Option 2: Students who do not follow the assessment of Option 1 are entitled to an alternative assessment, consisting of:

- Final written exam (85% of the final mark): similar to the final exam in option 1. To pass the course is necessary to obtain a minimum score of 5.
- Laboratory exam (15% of the final mark). A practical exam where the student will demonstrate that it is able to perform any of the sections proposed in the laboratory sessions. For this exam, students can have his/her lab notebook. To pass the course is necessary to obtain a minimum score of 5.

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The methodology followed in this course is oriented towards the achievement of the learning objectives. It favors the understanding and analysis of the different electrical circuits and the understanding of the main electrical machine principles. A wide range of teaching and learning tasks are implemented, such as theory and practical lectures, laboratory sessions, assignments, and autonomous work. Students are expected to participate actively in the class throughout the semester. Classroom materials will be available via Moodle. These include a repository of the lecture notes used in class, as well as other course-specific learning materials, including material for the autonomous work (self-assessment tests). Further information regarding the course will be provided on the first day of class.

4.2. Learning tasks

This is a 6 ECTS course organized as follows:

? Lectures (4.5 ECTS: 45 hours). Lecture notes and a set of problems (and their corresponding solutions) will be available for the students. At the end of each topic, some of the problems will be solved in a class by the teacher and the rest will be done individually.

? Laboratory sessions (1.5 ECTS: 15 hours). Three-hour sessions that take place approximately every 2 weeks in ?Laboratorio de Tecnología Eléctrica? (Building ?Torres Quevedo?, 2ndfloor). Students are provided in advance with task guidelines for each session.

? Assignments (1.02 ECTS: 25.5 hours). In small groups, students work on three different assignments during the course. In each one of them, the lecturer will assign from 2 to 4 problems to groups of 3 students, which they will submit to the teacher. Tutorials on the teacher?s office will allow students to solve the problems.

? Autonomous work (2.4 ECTS: 60 hours). Students are expected to spend this time to study theory, solve problems, and prepare laboratory sessions.

? Assessment activities (0.18 ECTS: 4.5 hours). Students will complete assignments, problems, and exercises related to concepts seen in laboratory sessions and lectures.

4.3. Syllabus

The contents of the course are divided into two main blocks, in which concepts of "Circuit Theory" and "Electrical Machines" are developed. In addition, the program adds a first introductory section in order to review basic issues (important for the subject understanding), and a final topic to describe the power lines which connect electrical machines. So, the course will address the following topics:

Lectures

? Section A. Introduction.

Topic 1: Electric and magnetic fields.

? Section B. Electric Circuit Theory.

Topic 2: Elements of an electrical circuit.

Topic 3: Electric DC circuits.

Topic 4: Electric single-phase AC circuits.

Topic 5: Power in single-phase AC circuits.

Topic 6: Electric three-phase AC circuits.

? Section C. Electric machines.

Topic 7: Electric machines: introduction.

Topic 8: Electric DC machines.

Topic 9: Electric asynchronous AC machines.

Topic 10: Electric transformers.

? Section D. Power lines.

Topic 11: Low-voltage power lines: wires and electrical protections.

Laboratory sessions

? Session 1. Analysis of direct current circuits.

? Session 2. Analysis of alternative current circuits (part I).

? Session 3. Analysis of alternative current circuits (part II).

? Session 4. Electrical automation: asynchronous motor control.

? Session 5. Electrical machines.

4.4. Course planning and calendar

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course will be provided on the first day of class or please refer to the "EINA" website and Moodle (https://eina.unizar.es, https://moodle2.unizar.es).