Universidad Zaragoza

Academic Year/course: 2022/23

25816 - Electric and electronic technology

Syllabus Information

Academic Year: 2022/23
Subject: 25816 - Electric and electronic technology
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
Degree: 558 - Bachelor's Degree in Industrial Design and Product Development Engineering
ECTS: 6.0
Year: 2
Semester: Second semester
Subject Type: Compulsory
Module:

1. General information

1.1. Aims of the course

The subject and its expected results respond to the following approaches and objectives:

The general objective of the subject is to provide basic knowledge about the use of electrical energy and its practical application. His approach is focused on the industrial design of devices that contain electrical or electronic components.

These approaches and objectives are aligned with some of Sustainable Development Goals, SDGs, of 2030 Agenda (https://www.un.org/sustainabledevelopment/es/) and certain specific goals, in such a way that the acquisition of the learning results of the subject provides training and competence to the student to contribute to a certain extent to their achievement.

Objective 8: Promote increase, inclusive and sustainable economic grow, full and productive employment and decent work for all.

Goal 8.8: Protect work rights and promote a safe working environment and without risks for all workers, including migrant workers particularly migrant women and people with precarious jobs.

1.2. Context and importance of this course in the degree

This subject belongs to the second semester of the second year of the degree, together with Economic and business aspects of design, Statistics and product reliability, Design Workshop III: Creativity and Graphic Design Applied to Products. A Module Project that includes these five subjects is planned.

1.3. Recommendations to take this course

Basic knowledge of Mathematics and Physics is required, consequently it is recommended to have passed these subjects in the first year of the degree. It is also recommended to have taken Computer Science in the first year, to have programming skills that will be applied in programmable logic devices.

2. Learning goals

2.1. Competences

To overcome the course, the student will be competent for...

CB01. Students have demonstrated knowledge and understanding in a field of study that is part of the general secondary education curricular and is typically at a level which, although it is supported by advanced textbooks, includes some aspects that involve knowledge of the forefront of their field of study.

CB02. Students can apply their knowledge to their work or vocation in a professional manner and have competences typically demonstrated through devising and defending arguments and solving problems within their field of study.

CB03. Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include an important reflection on social, scientific, or ethical issues.

CB04. Students can communicate information, ideas, problems, and solutions to both specialist and non-specialist audiences.

CB05. Students have developed those skills needed to undertake further studies with a high degree of autonomy.

CG01. Students are able to demonstrate knowledge and understanding of concepts in mathematics, statistics and computation and to apply them to solve problems in science and engineering with an ability for analysis and synthesis.

CG03. Students can solve computationally with the help of the most advanced computing tools mathematical models coming from applications in science, engineering, economy and other social sciences.

GC05. Capacity to collect, manage, analyze and synthesize information from various sources for the development of design projects and product development. Capacity to use this documentation to obtain conclusions aimed at solving problems and making decisions with initiative, creativity and critical thinking, in order to generate new product concepts, new ideas and solutions.

GC06. Ability to generate the necessary documentation for the proper transmission of ideas through graphics, reports and technical documents, models and prototypes, oral presentations in Spanish and other languages.

SC10. Know the principle of operation, characteristics and applications of the main electrical and electronic devices.

CB: BASIC COMPETENCIES. CG: GENERAL COMPETENCIES. SC: SPECIFIC COMPETENCIES.

2.2. Learning goals

Students have to demonstrate these following goals

1. Analyze DC and AC circuits.
2. Know the basis about electric and electronic devices
3. Identify electric and electronic components present in actual devices
4. Read technical documentation provided by manufacturers of electric and electronic devices.
5. Be conscious of electricity risk, acquire knowledge about electrical safety regulations.

2.3. Importance of learning goals

Learning goals are relevant to be applied in the following way:

- Know the most important electrical units and magnitudes.
- Analyze and solve AC and DC electrical circuits with passive elements (resistors, inductances and capacitors) and motors.
- Know how to use a voltmeter, amperemeter, ohmmeter, oscilloscope, etc.
- Interpret data sheets of electric components, electrical regulations, etc.
- Choose properly electric and electronic components suitable for designing devices: motors, diodes, LEDs, etc.
- Programming logical programmable devices to control electrical and electronic appliances.
- Acquire skills doing electrical assemblies.

3. Assessment (1st and 2nd call)

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

1. Final exam (45%)
2. Two control tests (10%):

- Control test 1 (5%): Basic concepts of electricity and DC current
- Control test 2 (5%): AC and three-phase current

1. Laboratory sessions (10%)
2. Programmable logic exercises with Arduino (5%)
3. Module Project (30%)

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The learning process that has been designed for this course is based on the following:

The learning process has been raised to promote continued student work and focuses on the theoretical basis to understand, analyze, and apply knowledge to solving real problems.

For the development of the subject, on the one hand, theoretical sessions will be taught with the entire group, in which the theoretical underpinnings of the subject in the form of lectures will be displayed and they will be supplemented by the resolution of classical problems.

On the other hand laboratory, sessions will be carried out in small groups where students will work as a member of a group of two or three students. The practice aims to apply the knowledge acquired in the theoretical sessions, focusing on assemblies of electrical circuits and measurements. It is intended for the student to know electrical and electronic devices, in order to acquire manual skills, and which reinforce the theoretical knowledge acquired.

4.2. Learning tasks

The course contains 6 ECTS credits corresponding to 150 hours, which includes the following learning tasks:

- 45 hours of lectures: 50% theoretical exposure and 50% of the classical problem's resolution.
- 15 hours of laboratory sessions: 5 sessions of 3 hours.
- 24 hours of practical work.
- 60 hours of personal study.
- 6 hours of testing.

4.3. Syllabus

The course will address the following topics:

- 1.- Basic concepts of electricity and DC current.
- 2.- Diodes and voltage regulators.
- 3.- Basic concepts of the magnetic field.
- 4.- AC current circuits.
- 5.- Three-phase current.
- 6.- DC motors.
- 7.- AC motors.
- 8.- Distribution of electric power and low voltage installations.
- 9.- Electrical protection and safety in electrical devices.

Practice sessions:

- **Practice 1:** Assembly of basic DC circuits (series, parallel and mixed). Measurement of electrical quantities (resistors, voltages and currents). Variable resistors (LDR, NTC).
- **Practice 2:** Assembly of a power supply (transformer, bridge rectifier, filter, voltage regulator).
- **Practice 3:** Assembly and analysis of basic AC circuits (RL and RC circuit). Management of the function generator and oscilloscope.
- **Practice 4:** Assembly and analysis of three-phase basic circuits. Measurement of three-phase currents, voltages and power.
- **Practice 5**: Basic testing of electric motors (consumption of currents, powers and speeds): DC motor, three-phase motor and single-phase motor.
- **Programmable logic with Arduino:** Practical exercises focused on the realization of the Module Project.

4.4. Course planning and calendar

Schedule

The course will last 14-15 weeks, that comprise about 43 hours distributed as follows:

- Basic concepts of electricity and DC current: 6 h
- Diodes and voltage regulators: 3 h
- Basic concepts of the magnetic field: 3 h
- Basic concepts of AC current: 3 h
- AC current circuits: 7 h
- Three-phase current: 6 h
- DC motors: 6 h
- AC motors: 3 h
- Distribution of electric power and low voltage installations: 3 h
- Electrical protection and safety in electrical devices: 3 h

Laboratory practices will be taught in 5 sessions of 3 hours. The practice sessions will take place every 2 weeks

4.5. Bibliography and recommended resources

http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=25816