Universidad Zaragoza

Academic Year/course: 2021/22

28818 - Electronic Technology I

Syllabus Information

Academic Year: 2021/22
Subject: 28818 - Electronic Technology I
Faculty / School: 175 - Escuela Universitaria Politécnica de La Almunia
Degree: 424 - Bachelor's Degree in Mechatronic Engineering
ECTS: 6.0
Year: 2
Semester: Second semester
Subject Type: Compulsory
Module:

1. General information

1.1. Aims of the course

The general objective of the subject is to provide the necessary knowledge to interpret and solve analog electronic circuits, especially in the areas of operational amplifiers and power supplies.

For this, the correct use of the most common computer applications for circuit simulation, the instrumentation for feeding and measurement of usual use in an electronic laboratory and correctly interpreting the technical documentation of the components used is necessary.

These approaches and objectives are in line with the following Sustainable Development Goals (SDGs) of the United Nations 2030 Agenda (https://www.un.org/sustainabledevelopment/es/), in such a way that the acquisition of the course learning outcomes provides training and competence to contribute to their achievement to some degree:

- Goal 9.1 Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all
- Goal 9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities

Indicators that the objectives have been achieved it, will be: the ability to interpret plans of commercial electronic equipment and applications, as well as the ability to make electronic schemes according to the regulations and appropriate symbols, and finally the realization of technical reports on the practical activities carried out.

1.2. Context and importance of this course in the degree

Electronic Technology I is part of the Mechatronic Engineering Degree taught by EUPLA, framed within the group of subjects that make up the module called Electricity and Electronics. It is a subject of the second year located in the fourth semester and a mandatory character (MC), with a teaching load of 6 ECTS credits.

It is part of the subject Electronic Technology that has six associated subjects, all of them of 6 ECTS credits, of which this is the first one that is proposed in the temporal sequence of the Degree, its content being centered on Analog Electronics.

It will have continuity with the subject Electronics Technology II, also mandatory (MC), which is being studied in the fifth semester focused on Digital Electronics; both form the basis for three other mandatory subjects (MC) that are studied in the sixth semester: Power Electronics, Electronic Instrumentation, and Programmable Electronic Systems.

In addition, the offer of training in Electronic Technology is completed with an optional subject (OP) called Advanced Instrumentation of the eighth semester.

1.3. Recommendations to take this course

The development of the subject of Electronic Technology I, requires putting into play the knowledge and strategies, the corresponding subjects in the previous semesters of Mechatronic Engineering Degree, related to:

Mathematics, Physics, Chemistry, Technical Drawing, Computer Science, and Electrical Engineering.

2. Learning goals

2.1. Competences

As generic and specific competences, the student will acquire:

- Knowledge of the fundamentals of electronics (EI05).
- Interpret and solve analog electronic circuits that use operational amplifiers (EE02 and EE04).
- Interpret and solve power supply circuits, adjusting their characteristics to the needs of the application where they are used (EE02 and EE04).
- GI03: Knowledge in basic and technological subjects that enable you to learn new methods and theories, and provide you with versatility to adapt to new situations.
- GI04: Ability to solve problems with initiative, decision-making, creativity, critical reasoning and to communicate and transmit knowledge, skills and abilities in the field of Industrial Engineering.
- GI06: Capacity to handle mandatory specifications, regulations and standards.
- GC02: Interpret experimental data, contrast it with the theoretical and draw conclusions.
- GC03: Capacity for abstraction and logical reasoning.
- GC04: Ability to learn continuously.
- GC05: Capacity to evaluate alternatives.
- GC06: Capacity to adapt to the rapid evolution of technologies.
- GC07: Ability to lead a team as well as being an active member of it.
- GC08: Ability to locate technical information, as well as its understanding and assessment.
- GC09: Positive attitude towards technological innovations.
- GC10: Ability to write technical documentation and to present it with the help of appropriate computer tools.
- GC11: Ability to communicate their reasoning and designs clearly to specialized and non-specialized audiences.
- GC14: Ability to understand the operation and develop the maintenance of mechanical, electrical and electronic equipment and installations.
- GC15: Ability to analyze and apply simplified models to technological equipment and applications that allow forecasting of their behavior.
- GC16: Ability to configure, simulate, build and test prototypes of electronic and mechanical systems.
- GC17: Capacity for the correct interpretation of plans and technical documentation.

2.2. Learning goals

The student, to pass this subject, must demonstrate the following results:

- Explain the behavior of basic electronic devices (active and passive), applying fundamental principles and electrical laws, using vocabulary, symbols and appropriate forms of expression.
- Select and correctly use the components of an analog electronic circuit corresponding to the area of power supplies, detailing their function in the block where they are used.
- Analyze the operation of typical electronic circuits, which use operational amplifiers, in both linear and non-linear behavior, describing their operation by means of calculation equations and input-output waveforms and transfer functions.
- Analyze and interpret diagrams and plans of basic characteristic electronic applications and equipment, including the function of an element or functional group of elements in the set, based on existing regulations.
- Select and interpret adequate information to raise and assess solutions to common technical needs and

problems in the field of Analog Electronics, with a level of accuracy consistent with the various magnitudes involved in them.

- Choose and properly use the typical measuring devices in the Electronic Laboratory, assessing its field of application and degree of precision.
- Know how to use the general methodology and the appropriate software tools to work in applied analog electronics.

2.3. Importance of learning goals

As this is the first subject taught in the Electricity and Electronics module, achieving good results in learning will provide the student with a basic level, which will facilitate the study of the other subjects of this module that are taught in later courses, especially in those of Power Electronics, and Electronic Instrumentation.

Applying the electrical laws and circuit theorems to the electronic schemes analyzed, correctly using the main magnitudes and electrical units, are essential in the professional practice of the Engineer, for which the ability to interpret technical documentation is also required: device datasheets electronics, equipment manuals, regulations, regulations, etc.

Analyze and solve basic circuits of both power supplies and operational amplifiers in linear and non-linear applications, are essential elements in the knowledge of Electronics necessary for any development in the field of Mechatronics, which must be revealed when selecting the most suitable electronic components for the design of application circuits of operational amplifiers and power supplies.

Know the management of the main electrical measuring devices: voltmeter, ammeter, ohmmeter, wattmeter, oscilloscope, etc. used in the electronics laboratory, and acquire manual dexterity in practical assemblies, will allow the student to consolidate the concepts taught in this subject as well as in the others that make up the Electricity and Electronics module.

3. Assessment (1st and 2nd call)

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

The student must demonstrate that they have achieved the expected learning outcomes through the following assessment activities

In general, the subject is divided into two blocks, the average of which in each of the parts will be used to calculate the final grade, except for the final work.

CONTINUOUS ASSESSMENT

An evaluation system for continuous monitoring of the subject is proposed, consisting of the following sections:

Written evaluation tests, of a theoretical - practical nature: It will consist of solving two questionnaires (one per subject block), where the student will show, through graphics, texts, equations and / or calculation, their mastery of the concepts worked in each block of matter. Their joint weight on the note is between 50 and 70%.

Laboratory practices: In each of the practices, the dynamics followed for its correct execution and operation will be assessed, as well as the problems raised in its development, the specific weight of this section being 30% of the total mark of the practice. The remaining 70% will be dedicated to the qualification of the report presented, that is, if the required data is correct and the questions raised have been answered correctly. It is an indispensable condition to pass the practices in continuous evaluation, to attend 80% of them. Its joint weight on the note is will be 30%.

If the laboratory practices could not be carried out in person for health reasons, it would be carried out electronically, that is, it would be transferred to a simulation practice format. It can even be done in a "mixed" way.

Exercises, theoretical questions and proposed work: Different exercises / tasks will be proposed in relation to the exposed during the development of the subject. Said tasks will refer to the blocks into which the subject is divided. The teacher may reject those works where the individual effort of the student is not demonstrated. Its joint weight on the note is will be up to 20%.

Subject Work (Voluntary): At the beginning of the course, the professor will propose a particular case of design and calculation of an electronic circuit that the student will develop throughout the semester, the results of which will be reflected in a report. Said report must include all the necessary calculations and justifications, as well as the pertinent simulations to validate the correct operation of the proposed development. This practical work will have a weight on the note of up to 20%.

Students whose weighted grade of the theoretical-practical exam, laboratory practices and proposed tasks is at least 5 points will pass the subject in continuous assessment. It is an indispensable condition to pass the subject in continuous evaluation, to attend 80% of the face-to-face activities: classes, technical visits, practices, etc.

GLOBAL ASSESSMENT

The student who does not pass the continuous monitoring evaluation system or does not wish to do it, will opt for a global evaluation, which is described below.

Theoretical-practical content exam: It will consist of solving two questionnaires (one per subject block), where the student will show, through graphics, texts, equations and / or calculation, their mastery of the concepts worked on in each block of matter. Its joint weight on the note is will be between 70%.

Laboratory practices: In the case of not being able to attend the laboratory continuously for personal reasons or not passing the practices by the continuous evaluation method. A practical exam will be carried out, which may well be a test in the laboratory where a practice of similar difficulty to those carried out in the laboratory during the course will be carried out. If the professor has it opportune, this test in the laboratory may be replaced by a written test where the student will be asked to demonstrate knowledge of the procedures, methodologies and setups carried out in the laboratory. The date of these examinations will be set according to the availability of the centre’s laboratories. Its joint weight on the note is will be 30%.

If the laboratory practices could not be carried out in person for health reasons, it would be carried out electronically, that is, it would be transferred to a simulation practice format. It can even be done in a "mixed" way.

Subject Work (Voluntary): At the beginning of the course, the professor will propose a particular case of design and calculation of an electronic circuit that the student will develop throughout the semester, the results of which will be reflected in a report. Said report must include all the necessary calculations and justifications, as well as the pertinent simulations to validate the correct operation of the proposed development. This practical work will have a weight on the note of up to 20%.

Students whose weighted grade for the theoretical-practical exam and the laboratory practices is at least 5 points will pass the subject in global assessment.

In general, the grades obtained in each of the blocks may be promoted to the next call / s within the same academic year as long as a grade equal to or greater than 4 points has been achieved.

On the first day of class, there will be a presentation of the subject where the evaluation models will be explained.

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

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

The teaching methodology is based on a strong teacher / student-a interaction. This interaction is materialized through a distribution of work and responsibilities between students and teachers. However, it must be considered that to a certain extent the students will be able to set their learning pace according to their needs and availability, following the guidelines set by the teacher.

If this teaching could not be carried out in person for health reasons, it would be carried out electronically.

4.2. Learning tasks

The program offered to the student to help him achieve the expected results includes the following activities:

- **Face-to-face activities:**
- Theoretical classes: The theoretical concepts of the subject will be explained and practical examples will be developed.
- Classes of problems: The teacher solves problems or practical cases for illustrative purposes. This type of teaching complements the theory presented in the lectures with practical aspects. On the other hand,
- Tutored problem solving: Students will develop examples and carry out problems or practical cases related to the theoretical concepts studied.
- Laboratory Practices: The total group of theoretical classes may or may not be divided into smaller groups, as appropriate. The students will carry out montages, measurements, simulations, etc. in the laboratories in the presence of the practical teacher.
- Autonomous activities tutored: These activities will be tutored by the teaching staff of the subject.
- Reinforcement activities: Through a virtual teaching portal (Moodle) various activities will be conducted that reinforce the basic contents of the subject. Its realization will be controlled through it.
- **Non-contact activities:**
- Study and assimilation of the theory presented in the lectures.
- Understanding and assimilation of problems and practical cases solved in practical classes.
- Preparation of seminars, resolution of proposed problems, etc.
- Preparation of the laboratory practices, elaboration of the scripts and corresponding reports.
- Preparation of the written tests of continuous evaluation, and global evaluation test.
- **Organization of teaching:**
- Lectures: Theoretical and / or practical activities taught primarily by the lecturer.
- Laboratory practices: practical activities carried out in the laboratories. The total group of lectures may or may not be divided into smaller groups, as appropriate. Students will be guided by the teacher's tutorial action
- Group tutorials: scheduled activities to monitor learning in which the teacher meets with a group of students to guide their autonomous learning and supervisory tasks for supervised work or that require a very high degree of advice from the teacher.
- Individual tutorials: These are those carried out through personalized attention, individually, they may be face-to-face or virtual.

The subject consists of 6 ECTS credits, which represents 150 hours of student work on the subject during the semester. 40% of this work (60 h.) Will be done in the classroom, and the rest will be autonomous. A semester will consist of 15 school weeks.

Global temporal distribution:

The course consists of 6 ECTS credits, which represents 150 hours of student work on the subject during the semester, that is, 10 hours per week during 15 school weeks, which are distributed as follows:

- **44 hours of theoretical class:** 50% presentation of concepts and 50% resolution of standard problems, at a rate of 4 hours per week, except in the weeks of practices or the weeks with a control test, which will be reduced by two hours.
- **12 hours of tutored laboratory practice:** weeks 1 to 15 sessions of 2 hours in alternate weeks.
- **4 hours of control tests** (2 controls of 2 hours), which will be carried out (approximately) in the 8th and 15th weeks.
- **30 hours of group work:** spread over the 15 weeks of the semester.
- **60 hours of personal study:** at a rate of 4 hours in each of the 15 weeks of the semester, to prepare work, do exercises, study theory, etc...

A teaching week temporal distribution:

Subject is defined in the Bachelor's Degree Verification Report with a low experimental grade, so the 10 hours

per week are distributed as follows:

- **Theoretical-practical classes:** 3 hours per week
- **Laboratory practices:** 1 hour per week
- **Other activities:** 6 hours a week

4.3. Syllabus

Contents of the subject essential for obtaining learning results.

Theoretical Contents:

The theoretical contents are articulated based on two blocks (numbers 1 to 2) preceded by a block 0 of introduction to Electronic Technology. The choice of the content of the blocks has been made seeking the express clarification of the terminal objective, so that, with the union of incident knowledge, the student obtains a structured knowledge, easily assimilated by Mechatronics Engineers.

Each of the blocks is made up of topics, with a temporary assignment of one or two weeks of the course, these topics collect the necessary content for the acquisition of the predetermined learning results, according to the following relationship:

Block 0: INTRODUCTION

0.- Passive electronic components

Block 1: DIODES, TRANSISTORS AND APPLICATION CIRCUITS

1.- Active components: semiconductors and diodes

2.- Circuits with diodes

3.- Active components: BJT Transistors and Circuits with BJT Transistors

4.- Active components: FET transistors and Circuits with FET transistors

Block 2: OPERATIONAL AMPLIFIERS AND LINEAR AND NON-LINEAR APPLICATIONS

5.- Operational Amplification

6.- Linear Circuits with Operational Amplifiers

7.- Nonlinear Circuits with Operational Amplifiers

8.-Active Converters and Filters

Topic 9: Power supplies.

It will be developed throughout the course, as the syllabus evolves. DESIGN WORK (OPTIONAL)

Practical Contents:

Each block exposed in the previous section has associated practical exercises in this regard, through practical assumptions and / or physical or simulated assembly work, leading to obtaining results and their analysis and interpretation.

As the topics develop, these Practices will be proposed, preferably in class and also through the Moodle platform, they will be carried out by the students in weekly sessions of one hour, during the time dedicated to each Block.

4.4. Course planning and calendar

Calendar of face-to-face sessions and presentation of work

The calendar of the face-to-face classes of theory and problems, as well as the computer practical sessions, will have the schedule established by the EUPLA, which can be consulted on its website.

Each teacher will inform about their tutoring schedules.

The dates of the final exams will be those published officially at https://eupla.unizar.es/asuntos-academicos/examenes. The final calendar of the corresponding academic year can be seen on the website of the educational center https://eupla.unizar.es/.

The class schedules, as well as the distribution of groups for practices will be transmitted to the students by the teacher at the beginning of the academic year, it will be published on the Moodle platform as well as on the website of the university center (https://eupla.unizar.es/).

The dates of other activities: (evaluative tests, seminars, compulsory practices, delivery of work ...) will be published in advance by the teacher both in class and through the Moodle platform.

Testing schedule

For the evaluation tests, described in the continuous evaluation process, the following approximate schedule is proposed:

- **Test 1:** Topics 1, 2, 3, 4 and 5 (Week 8)
- **Test 2:** Topics 6, 7, 8, 9 and 10 (Week 15)

The weekly schedule of the subject will be published at http://www.eupla.es/

4.5. Bibliography and recommended resources

http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=28818