Universidad Zaragoza

Year : 2019/20

28818 - Electronic Technology I

Syllabus Information

Academic Year: 2019/20
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.

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 centred 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.

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 data sheets 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)

4.Methodology, learning tasks, syllabus and resources

4.1.Methodological overview

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

This subject, Electronics Technology I, is conceived as a set of contents divided into four main parts. The first part gathers basic concepts of Electronics, which maybe students have already acquired in other subjects. The second and third parts form the core of the subject. The final block, meet other interesting complementary skills to complete training in Analog Electronics.

The first three blocks will be developed under three fundamental and complementary ways: the theoretical concepts of each teaching unit, solving problems or issues, and laboratory practices, supported in turn by another series of activities such as tutorials and seminars and will be tested, independent for each of the theory parts.

The fourth block will have a different treatment, as a group work previously assigned. Students may have and express their own preferences, but all topics will be assigned. They will prepare presentation materials and defend their work with a public exhibition, which will be valued by the other students and the teacher.

Strong interaction between the teacher/student. This interaction is brought into being through a division of work and responsibilities between the students and the teacher. Nevertheless, it must be taken into account that, to a certain degree, students can set their learning pace based on their own needs and availability, following the guidelines set by the teacher.

A wide range of teaching and learning tasks are implemented, such as:

? **Lectures**: Theoretical activities carried out mainly through exposition by the teacher, where the theoretical supports of the subject are displayed, highlighting the fundamental, structuring them in topics and or sections, interrelating them.

? **Practice Sessions**: The teacher resolves practical problems or cases for demonstrative purposes. This type of teaching complements the theory shown in the lectures with practical aspects.

? **Seminars:** The total group of theory classes or practical classes may be (or not) divided into smaller groups, if necessary. They were employed to analyze cases, solving cases, solving problems, etc. Unlike what happens with the practical classes, the teacher is not the protagonist, merely to listen, serve, guide, clarify or evaluate. It seeks to encourage student participation and try to facilitate the continuous evaluation of students and meet learning achievement.

? **Laboratory Workshop**: The lecture group is divided up into various groups, according to the number of registered students, but never with more than 20 students, in order to make up smaller sized groups. Students will complete assemblies, measurements, simulations, etc. in the laboratory, in the presence of the teacher. The practices will be carried out in groups of two (or three if necessary) students per session, although reports can be grouped students from two or more sessions. For each part of laboratory practices, the guidance of practical tasks (compulsory and optional) will be delivered; the reporting rules will also be specified in a policy paper at the beginning of practical activities. Three times during the semester, students should defend their laboratory work by showing the corresponding practical work and answering some questions from the teacher.

? **Group Tutorials**: Scheduled tracking learning activities, in which the teacher meets with a group of students, in order to guide their autonomous learning work and to track that jobs which require a high degree of advice from the teacher.

? **Individual Tutorials**: Those carried out giving individual, personalized attention with the teacher of the subject or another teacher from the department. Said tutorials may be in person or online.

4.2.Learning tasks

The course includes the following learning tasks:

Generic on-site activities:

- **Lectures:** The theoretical concepts of the subject will be explained and illustrative practical examples will be developed as support for the theory when it is deemed necessary.
- **Practical lessons:** Problems and practical cases will be made as a complement to the theoretical concepts studied.
- **Practical tasks:** Students will be divided into several groups of no more than 20 students, being guided by the tutorial action of the teacher.
- **Defense and presentation of topics:** on the particular contents that are assigned to each group of students, corresponding to Block 4.

Generic off-site activities:

- Study and assimilation of the theory explained in the lectures.
- Understanding and assimilation of solved cases in practical lessons.
- Preparation of seminars, solving suggested problems, etc.
- Participation in Forums of the subject via Moodle, to provide links of information on the Internet.
- Preparation and development of scripts and corresponding reports.
- Preparation of written continuous assessment tests, and global assessment tests.

Autonomous tutored activities:

Although they will be done on-site, they have been taken into account separately because of their particular features, they will be focused mainly on seminars and tutorials under the supervision of the teacher.

Reinforcement activities:

Off-site activities preferably, via the virtual portal of teaching (Moodle), will be designed to reinforce the basic contents of the subject. These activities can be personalized or not.

4.3.Syllabus

Theoretical contents:

The theoretical contents are articulated on four Sections (numbers 1-4), sometimes preceded by a Section 0 of Introduction to Electronic Technology. The choice of the contents of each part was made by seeking the clarification of the final objective so that by the union of the acquired knowledge, the student must obtain a structured, easily assimilable for Mechatronics Engineers knowledge.Each of the Sections consists of different topics, with a temporary assignment of one or two weeks of the course. These topics collect the contents needed to the acquisition of learning outcomes, according to the following relationship:

- **Section 1: ACTIVE AND PASSIVE ELECTRONIC COMPONENTS**
  - **1. Passive electronic components**
    - Resistors, capacitors, inductors
    - Manufacturing and identification
  - **2. Active components: semiconductors and diodes**
    - Semiconductor materials
    - Diodes. Types. Crystals. Symbols
    - Operation graphs. Identification
  - **3. Active components: Transistors**
    - Unipolar and Bipolar Transistors
    - Crystal structures. Symbols
    - Operation graphs. Identification
- **Section 2: CIRCUITS WITH DIODES AND TRANSISTORS**
  - **4. Circuits with diodes**
    - Rectifiers (and filters)
    - Regulators (Zener)
    - Other diodes and applications
  - **5. BJT.**
    - Characteristics
    - Polarization
    - AC circuit
    - Small signal equivalent
  - **6. FET**
    - Characteristics
    - Polarization
    - Application of FET. MOSFET. JFET. IGFET.
- **Section 3: OPERATIONAL AMPLIFIERS AND APPLICATIONS**
  - **7. Amplification and voltage Operational Amplifiers**
    - Types of amplification. Models
    - Key features
    - Output stages
    - Feedback
    - Symbols and internal structure
    - Input and output circuits
    - Key features
  - **9. Basic Linear applications with Operational Amplifiers**
    - Simple Amplifiers
    - Amplifiers simple operations
    - Amplifiers complex operations
    - Active filters
  - **10. Nonlinear and Switching Circuits Operational Amplifiers**
    - Precision Rectifiers
    - Voltage comparators
    - Timers

- Oscillators

- **Section 4: OTHER SPECIAL APPLICATIONS WITH INTEGRATED CIRCUITS**
  - **11. INA and Bi-FET**
    - Applications for industrial probes: temperature, speed, ...
    - Electro-medical applications: biological probes ...
    - Audio-frequency applications: sound level meters, vibration, ...
  - **12.- IC 555 timer**
    - IC study
    - Monostable applications
    - Astable applications
  - **13. Operational Transconductance Amplifiers**
    - Study of integrated circuits
    - Linear applications
    - Nonlinear Applications
  - **14. Operational Transresistance Amplifiers**
    - Study of integrated circuits
    - Linear applications
    - Nonlinear Applications
- **Practical contents:**
  Each exposed in the previous section, the Section has associated practical exercises about through practical cases and/or work, leading to the obtaining of results and their analysis and interpretation physical or simulated assembly. While topics are developed, laboratory practices will be proposed, mainly through the Moodle platform, they will be performed by students / as in weekly sessions of one hour, during the time spent on each Section.

4.4.Course planning and calendar

Calendar of classroom sessions and presentation of works

The planned development of the course includes (6 ECTS credits, or 150 hours), which will be distributed as follows:

- 48 hours of theoretical class: 60% of exposition of concepts and 40% of problem resolution (3 hours per week), except in the weeks with a control test, which will be reduced one hour, and in the final weeks that will increase two hours.
- 15 hours of supervised laboratory practices: 1st to 15th-week sessions of 1 hour.
- 15 hours of seminars and group work: to complete the practical activities of each block and especially for the preparation of block 4.
- 66 hours of personal study: at a rate of 4 hours per week during the semester, to prepare work, to solve exercises, study theory, etc.
- 6 hours of control tests (3 controls of 2 hours), which will be carried out (approximately) in the weeks: 3rd, 7th and 12th.
  At this computation of 150 hours will be added 3 hours of global evaluation test, in two calls.

The dates of the global evaluation tests will be those published officially at http://www.eupla.unizar.es/asuntos-academicos/examenes. Its duration is not included in the calculation of the 150 hours.

The topics of Block 4 (Themes 11, 12, 13 and 14) will be assigned during the development of Block 2 (4th to 7th weeks), being carried out until the end of the 11th week and the exhibition during the final weeks (13th to 15th). More details will be specified along the course.

4.5.Bibliography and recommended resources

http://biblos.unizar.es/br/br_citas.php?codigo=28818&year=2019