COURSE DATA

Data Subject	
Code	34813
Name	Analogue electronics I
Cycle	Grade
ECTS Credits	6.0
Academic year	2023 - 2024

Study (s)

Degree	Center	Acad. year	Period
1402 - Degree in Telecommunications Electronic Engineering	School of Engineering	2	Second term

Subject-matter

Degree	Subject-matter	Character
1402 - Degree in Telecommunications Electronic Engineering	16 - Electronics	Obligatory

Coordination

Name	Department
ESPERANTE PEREIRA, DANIEL	242 - Electronic Engineering

SUMMARY

Analogue Electronics I is a subject of a second degree course in *Electronics & Telecommunication Engineering.* As shown in the curriculum, the descriptors of this subject within the subject "Electronics" establish the following topics:

1. Signals, systems and basic analog components.
2. Transistor amplifiers and feedback in electronic systems.
3. Power supplies and regulators.
4. Operational amplifiers.
5. Analog-digital conversion.

It is, therefore, a subject whose content is essential for the initiation of Grade in *Electronics & Telecommunication Engineering.* This subject is continued in the Analogue Electronics II to be taught in the third year of the same degree.
Analog Electronics I reviews the most commonly used electronic components, both passive and active, and basic circuits, giving the practical procedures for use in the laboratory.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

For the successful use of this subject should have prior knowledge acquired in the subjects of Electronic Circuits and Electronic and Photonic Devices.

COMPETENCES (RD 1393/2007) // LEARNING OUTCOMES (RD 822/2021)

1402 - Degree in Telecommunications Electronic Engineering

- G3 - Acquisition of the knowledge of the basic and technological subjects that allows students to learn new methods and theories and endows them with the versatility to adapt to new situations.
- G4 - Ability to solve problems with initiative, decision-making and creativity, and to communicate and transmit knowledge, abilities and skills, understanding the ethical and professional responsibility of the activity of a telecommunications technical engineer.
- G9 - Ability to work in a multidisciplinary environment and in a multilingual group and to communicate, in writing and orally, knowledge, procedures, results and ideas related to telecommunications and electronics.
- G6 - Ability in the handling of specifications, regulations and norms of compulsory compliance.
- TE5 - Ability to design circuits for analog and digital electronics, analog-digital and digital-analog conversion, radio frequency, power and power conversion for telecommunications and computing applications.

LEARNING OUTCOMES (RD 1393/2007) // NO CONTENT (RD 822/2021)

After completing this course, students will be able to:

- Analyze in detail the behavior of any linear analog circuit of medium difficulty (G3,G5).
- Know the different types of devices to address analog electronic design (G3,G6).
- Knowing how to choose the most appropriate type of circuit according to the needs of a design. (G4,TE5).
- To design an electronic system that meets a set of specifications. (G4,TE5).
- Perform the circuit diagram and its simulation. (G4,TE5).

- Proceed with the physical realization of a prototype and testing. (G4,TE5).
- Knowing how to choose the type of amplifier circuit more suitable to the needs of a design. (G4,G6).
- Know linear power design that meets a set of specifications. (G4,G6,TE5).
- Understand in detail the structure of an operational amplifier and the basis of operational design of circuits. (G4,G6,TE5).

DESCRIPTION OF CONTENTS

1. Introduction and basic elements

Item 1. Signals, systems and basic analog components.
1.1. Basic definitions: device, system and signal
1.2. Analog and digital electrical signals
1.3 Specification of a system or electronic circuit
1.4. Basic analog components

2. Amplifiers

Item 2. Transistor signal amplifiers.
2.1. The BJT amplifier
2.1.1. Common emitter amplifier
2.1.2. Common collector amplifier
2.1.3. Common base amplifier
2.2. The FET amplifier
2.2.1. Common source amplifier
2.2.2. Common drain amplifier
2.2.3. Common gate amplifier
2.3. The differential amplifier

Item 3. Frequency response of amplifiers.
3.1. Characteristics of the frequency response of an amplifier
3.2. Model and frequency response of BJT
3.3. Frequency response of amplifiers with common-emitter BJT
3.4. Coupling capacitor

3. Feedback and operational amplifiers

Item 4. Feedback in amplifiers.
4.1. Feedback concept
4.2. Feedback effects on amplification
4.3. Types of feedback

Item 5. The operational amplifier.
5.1. General properties of the operational amplifier

5.2. Inverting amplifier
5.3. Noninverting amplifier
5.4. Limitations of real operational amplifier
5.5. Circuits with operational amplifiers

4. Power supplies

Item 6. Power supplies and regulators.
6.1. Introduction
6.2. Transformers
6.3. Rectification
6.4. Regulators

5. Analog-to-digital and digital-to-analog conversion

Item 7. Analog-to-digital and digital-to-analog conversion.
7.1. Introduction.
7.2. Digital-to-analog converters: types.
7.3. Analog-to-digital converters: types.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	30,00	100
Laboratory practices	20,00	100
Classroom practices	10,00	100
Development of group work	20,00	0
Study and independent work	15,00	0
Preparation of evaluation activities	20,00	0
Preparing lectures	15,00	0
Preparation of practical classes and problem	20,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

The teaching methodology is organized in three types of activities. In all cases, the student will have access in advance to the teaching material related to the contents of the subject through the Virtual Classroom (the University of Valencia's e-learning platform), in order to facilitate the preparation of the classes. The content will be based on notes, transparencies and multimedia material, both internal and external, in order to reinforce concepts. The students will have an approximate timing of the development of the subject during the whole term. Attendance to all face-to-face classes will be noted.

• **Theoretical lessons.** In the theoretical classes the topics will be developed providing a global and integrating vision, analyzing with more detail the key and more complex aspects. To encourage student participation, the master classes will alternate with examples to be solved jointly by the teacher and the students. The teacher will also be able to evaluate the student's previous preparation by means of questions at the beginning of the class. Emphasis will also be placed on practical aspects of design and engineering. During the classes and at the end of each topic there will be exercises and questionnaires that can be handed in, both on paper and in digital format.

• **Practical lessons.** In the practical classes there will be sessions of discussion and resolution of the most significant problems of each section of the subject. There will be problem reports that will be developed in groups, with some sessions in class. We will tend to the inverse class methodology. (G9, G4, TE5)

• **Lab classes.** In each laboratory class, both the previous preparation of the practice to be carried out, by checking the design and simulation of the circuits, and the final results will be evaluated. An attendance control will be carried out. (G9, G4,TE5)

EVALUATION

The evaluation of learning will be carried out prioritizing the continuous evaluation and the participation of the students throughout the course, and through a final exam of theory and laboratory. The evaluation will measure the achievement of the objectives in two blocks: Block A, which will collect the knowledge of theory and Block B, which will collect the practical and laboratory knowledge. It will be necessary to obtain a minimum grade of 4 in both blocks to pass the minimum required knowledge and to be able to obtain averages. The final grade will be the weighted average of both blocks as specified below.

There will be two exam sessions coinciding with the official exams.

First call. The first call will prioritize the continuous evaluation and the student's work. The percentage assignment of each part of the evaluation in the first call will be as follows:

Block A: theory

- Attendance and participation: 10%.
- Class questionnaires: 15%.
- Final exam of theory and problems: 45%.

Block B: practical activities

- Laboratory: 15%.
- Deliverable problems: 15%.

The final exam of theory and problems will be held individually on the date, time and place officially designated by the center and will evaluate the knowledge and concepts acquired by the student and his ability to solve problems based on the experience, knowledge and skills acquired. This exam will consist of two parts, one of theory questions and the other of problems, which will be weighted differently in the final grade of the theory exam. A minimum grade of 4 will be necessary in the questions part for the problems part to be evaluable. It will be necessary to obtain a minimum grade of 4 in the total of the exam to pass the minimum knowledge required and to be able to obtain averages. In addition, it is foreseen the possibility of taking a partial exam in the middle of the syllabus in order to free up material for the final exam. This test will be of the same type as the final exam and its weight will be of 50% of the final grade of the final exam of theory and problems in case of obtaining a minimum grade of 4.

The grade for attendance and participation will be proportional to the student's attendance to the face-to-face classes, and to the participation in the tasks proposed in the same, giving priority to the voluntary activities. The quality and attention of the interventions in the debates of the problems will be valued.

The grade of the class questionnaires will be obtained by evaluating and averaging the results of the questionnaires and challenges, both in digital and physical format, that the professor will propose during the classes.

The laboratory grade will be obtained as a result of evaluating each practical, which will be divided into previous calculations and performance of the practical. They may be evaluated by means of questions, questionnaires or deliverable reports, depending on the nature of the practical. The continuous evaluation of each practical (preparation 30%, realization 70%) will constitute the total of the final laboratory grade.The professor will be able to keep this laboratory grade for the following course.

The grade of the deliverable problems will be obtained from the evaluation by the professor of the technical quality of the solution to the problems that are posed throughout the course, both in digital format and in physical format.

Second call: The percentage assignment of each part of the evaluation in the first call will be the following:

Block A: theory

- Attendance and participation: 5%.
- Class quizzes: 10%.
- Final exam of theory and problems: 60%

Block B: practical activities

- Laboratory: 15%
- Deliverable problems: 10%.

The final exam of theory and problems will be held individually on the date, time and place officially designated by the center and will evaluate the knowledge and concepts acquired by the student and his ability to solve problems based on the experience, knowledge and skills acquired. This exam will consist of two parts, one of theory questions and the other of problems, which will be weighted differently in the final grade of the theory exam.A minimum grade of 4 will be necessary in the questions part for the problems part to be evaluable. It will be necessary to obtain a minimum grade of 4 in the exam to pass the minimum knowledge required and to be able to obtain averages.

The grade for attendance and participation will be proportional to the student's attendance to the classes, and to the participation in the tasks proposed in the same, giving priority to the voluntary activities. The quality and attention of the interventions in the debates of the problems will be valued.

The grade of the class questionnaires will be obtained by evaluating and averaging the results of the questionnaires and challenges, both in digital and physical format, that the professor will propose during the classes.

The laboratory grade will be obtained as a result of evaluating each practical, which will be divided into previous calculations and performance of the practical. They may be evaluated by means of questions, questionnaires or deliverable reports, depending on the nature of the practical. The continuous evaluation of each practical (preparation 30%, realization 70%) will constitute the total of the final laboratory grade. For students who have not obtained a grade of 4 or higher by attending the laboratories, there will be an exam in this call on the date and time officially designated by the center for the official exam of the subject in the second call, after the final exam of theory. In this case, the grade of this exam will represent 100% of the laboratory block grade, and it will be essential to obtain at least a 4 out of 10. Students who have not attended at least 75% of the laboratory sessions during the course will not be able to take this exam.

The grade of the deliverable problems will be obtained from the evaluation by the teacher of the technical quality of the solution to the problems that will be presented throughout the course, both in digital and physical format. If the student has not done the problems through continuous evaluation, he/she must request a list of problems to the professor and individually present a report on the solution of these problems and a digital presentation of them before the day of the second exam.

REFERENCES

Basic

- Referencia b1: Allan R. Hambley. Electrónica. Pearson Education, 2001.

  Referencia b2: Horowitz-Hill. The Art of Electronics. Cambridge University Press 1989.

  Referencia b3: Espí, Camps, Muñoz. Fundamentos de Electrónica Analógica. Servicio de Publicaciones de la Universidad de Valencia (SPUV), 2006.
  Referencia b4: Espí, Camps, Muñoz. Electrónica Analógica: Problemas y cuestiones. Prentice Hall. Serie Prentice/Práctica, 2006.

Referencia b5: Documentación preparada por el profesorado para la asignatura, accesible a los alumnos a través de Aula Virtual.

Additional

- Referencia c1: J. Millman y A. Grabel. "Microelectrónica" Ed. Hispano Europea. 1991
  Referencia c2: Enlaces web específicos y aplicaciones de electrónica: empresas del sector y hojas de características de componentes.