# COURSE DATA

## DATA SUBJECT

**Code:** 34281
**Name:** Electronics
**Cycle:** Undergraduate Studies
**ECTS Credits:** 6
**Academic year:** 2026-27

## STUDY (S)

| Degree | Center | Acad. year | Period |
|---|---|---|---|
| 1105 - Degree in Physics | Facultat de Física | 4 | Second quarter |

## SUBJECT-MATTER

| Degree | Subject-matter | Character |
|---|---|---|
| 1105 - Degree in Physics | Complements of Physics | ELECTIVES |

## COORDINATION

DEL CANTO SERRANO IRENE

# SUMMARY

This course tries to convey basic knowledge to understand the circuits and electronic subsystems of interest in the field of physics. It is intended for students to apply this knowledge to solve practical cases and use it for the development of experimental techniques. In addition to basic knowledge, it also provides an overview of state of the art in electronic technology and applied physics.

Descriptors: fundamentals and basic laws of electronics, electronic components, basic techniques in analog electronics, digital electronics basics, fundamentals of communications, current affairs.

# PREVIOUS KNOWLEDGE

## RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

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

## OTHER REQUIREMENTS

It is recommended to have prior knowledge of Electromagnetism and Solid State Physics.

## COMPETENCES / LEARNING OUTCOMES

### 1105 - Degree in Physics

Ability to collect and interpret relevant data in order to make judgements.

Basic & applied Research: acquire an understanding of the nature and ways of physics research and of how physics research is applicable to many fields other than physics, e.g. engineering; be able to design experimental and/or theoretical procedures for: (i) solving current problems in academic or industrial research; (ii) improving the existing results.

Communication Skills (written and oral): Being able to communicate information, ideas, problems and solutions through argumentation and reasoning which are characteristic of the scientific activity, using basic concepts and tools of physics.

Foreign Language skills: Have improved command of English (or other foreign languages of interest) through: use of the basic literature, written and oral communication (scientific and technical English), participation in courses, study abroad via exchange programmes, and recognition of credits at foreign universities or research centres.

Knowledge and understanding of the fundamentals of physics in theoretical and experimental aspects, and the mathematical background needed for its formulation.

Learning ability: be able to enter new fields through independent study, in physics and science and technology in general.

Literature Search: be able to search for and use physical and other technical literature, as well as any other sources of information relevant to research work and technical project development.

Modelling & Problem solving skills: be able to identify the essentials of a process / situation and to set up a working model of the same; be able to perform the required approximations so as to reduce a problem to an approachable one. Critical thinking to construct physical models.

Physics general culture: Be familiar with the most important areas of physics and with those approaches which span many areas in physics, or connections of physics with other sciences.

Problem solving: be able to evaluate clearly the orders of magnitude in situations which are physically different, but show analogies, thus allowing the use of known solutions in new problems .

Students must be able to apply their knowledge to their work or vocation in a professional manner and have acquired the competences required for the preparation and defence of arguments and for problem solving in their field of study.

Students must be able to communicate information, ideas, problems and solutions to both expert and lay audiences.

Students must have acquired knowledge and understanding in a specific field of study, on the basis of general secondary education and at a level that includes mainly knowledge drawn from advanced textbooks, but also some cutting-edge knowledge in their field of study.

Students must have developed the learning skills needed to undertake further study with a high degree of

autonomy.

Students must have the ability to gather and interpret relevant data (usually in their field of study) to make judgements that take relevant social, scientific or ethical issues into consideration.

To know how to apply the knowledge acquired to professional activity, to know how to solve problems and develop and defend arguments, relying on this knowledge.

## DESCRIPTION OF CONTENTS

### 1. Foundations of Electronics, Basic Laws and Electronic Components

- Introduction to electronics. - Types of electronic systems. - Electronics in Physics: block diagram. - Signals: units and measurements. - Kirchoff's Laws, Thevenin and Norton theorem. - Components R, L, C and basic RLC circuits.

### 2. Analog circuits with discrete components: diodes and transistors

- The junction diode. Diode as circuit element: approximations. - Circuits with diodes. Applications. - Zener diode. - Other diodes. - The Bipolar Transistor (BJT). BJT as a circuit element: approximations. Examples of circuits with BJTs. - The Field Effect Transistor FET. - Other transistors.

### 3. Analog circuits with integrated components: the operational amplifier.

- Feedback. - The ideal operational amplifier (OA). - The 741 OA. - Linear and no linear circuits with OAs.

### 4. Digitization: AD and DA converters. Pulse propagation.

- Nyquist Sampling Theorem. - AD converters. - DA convertes. - Data Acquisition. Exemples in physics. - Pulse propagation in a transmission line. Particular cases in coaxial cables.

### 5. MSI Digital Circuits.

- Boole¿s Algebra. - Logic functions. - Logic Gates. - Combinational Circuits. - Sequential Circuits. - Timing Circuits. - Exemples in physics.

### 6. Programmable Logic Devices and Microcontrollers.

- Programmable Devices. PLDs, CPLDs, FPGAs. - Microcontrollers. Arquitecture, development tools and programming. - Data Acquisition in physics using semi-custom digital systems.

# WORKLOAD

## PRESENCIAL ACTIVITIES

| Activity | Hours |
|---|---|
| Theory | 30,00 |
| Laboratory | 30,00 |
| **Total hours** | **60,00** |

## NON PRESENCIAL ACTIVITIES

| Activity | Hours |
|---|---|
| Attendance at other activities | 0,00 |
| Individual or group project | 10,00 |
| Independent study and work | 35,00 |
| Preparation of lessons | 20,00 |
| Preparation for assessment activities | 15,00 |
| Resolution of case studies | 10,00 |
| **Total hours** | **90,00** |

# TEACHING METHODOLOGY

Face-to-face teaching (40%):

Theoretical-practical classes: The conceptual and formal aspects of the subject and the resolution of problems or cases as an application of the theoretical concepts are addressed. They are mainly based on the dialogued lectures and the use of teaching tools such as experimental demonstrations, animations or videos, graphical representation of solutions, projection of presentations, etc.

Group tutoring sessions or work in small groups: focused on the student's work and active participation: resolution of doubts that arose when facing theoretical concepts and problem solving, reinforcement in more difficult aspects, conceptual questionnaires , experimental demonstrations relevant to the cases studied and, associated with a component of continuous assessment, verification of the student's progress in the subject.

Laboratory sessions in small groups: In pairs or individually, students carry out practices with experimental devices related to the concepts exposed in the theoretical and problem classes, with special emphasis on understanding the physical phenomena involved, using the appropriate scientific instruments and carrying out a preliminary analysis of the measurements.

Student's personal work (60%):

Including

Study of the theoretical foundations

Problem solving, individually and in groups

Preparation of experimental work, preparation of data and experimental results and writing of reports or reports on the work carried out.

Individual tutorials: specific consultations of the student about doubts and difficulties encountered in the study and in solving problems, or discussion on topics of interest, bibliography, etc.

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## EVALUATION

In both the first and second examination periods, the final mark for the course unit will be determined according to the following assessment methods:

SE1. Written examination consisting of multiple-choice questions, conceptual and application-oriented questions, and the solution of one or more problems. (40%)

SE2. Continuous assessment. Completion of theoretical and practical assignments throughout the teaching period, aimed at evaluating design aspects, problem-solving skills, and the interpretation and analysis of experimental results. (20%)

SE3. Laboratory assessment. Evaluation of the activities carried out in the laboratory and submission of one or more technical reports. (40%)

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## REFERENCES

- Material de la asignatura, disponible en el Aula Virtual
- Malvino, Principios de Electrónica. Ed. Mc Graw Hill
- Floyd, Fundamentos de Sistemas Digitales. Ed. Prentice Hall
- Horowitz, The Art of Electronics. Ed. Cambridge

- Argawall, Foundations of Analog and Digital Electronic Circuits. Ed. Elsevier
- Swerz, Practical Electronics for Inventors. Ed. Mc Graw Hill