Universidad Zaragoza

Academic Year/course: 2024/25

26928 - Physical Electronics

Syllabus Information

Academic year: 2024/25
Subject: 26928 - Physical Electronics
Faculty / School: 100 - Facultad de Ciencias
Degree: 447 - Degree in Physics
ECTS: 6.0
Year: 4
Semester: First semester
Subject type: Compulsory
Module:

1. General information

The objective of this subject is the understanding and analysis of the internal physical mechanisms associated with the phenomena of electrical conduction in semiconductors, which is the basis for the study of the main solid state electronic devices and their basic applications in current electronic systems. Thus, starting from a microscopic characterization, it is possible to describe its macroscopic behaviour, establishing the relationships between currents and voltages at the terminals of the device. The last level of description is the elaboration of equivalent models, which characterize the global behaviour of the device, and constitute the basis for the analysis and design of electronic systems.

These approaches and objectives are aligned with the Sustainable Development Goals: Goal 4: Quality Education; Goal 8: Decent work and economic growth.

2. Learning results

Upon completion of the subject, the student will be able to:

- Calculate mobile carrier concentrations in semiconductors.
- Characterize the basic properties of electronic transport in semiconductors.
- Determine the characteristic equation of a semiconductor device from the continuity equation.
- Model by means of circuit elements the static behaviour of semiconductor devices in their different operating zones
- Obtain incremental equivalents that, including dynamic effects, describe the devices in a small region of their operation
- Analyse and design basic amplifier configurations.
- Analyse and design basic logic gates.
- Experimentally characterize a semiconductor device with extraction of its main parameters.

3. Syllabus

Block I. Semiconductors

1. Fundamentals.
2. Intrinsic and extrinsic semiconductors.
3. Carrier- transport.

Block II. Junction diodes

4. P-n junction
5. Junction diodes.

Block III. BJT transistors

6. Bipolar junction transistor.
7. Bipolar transistor: applications.

Block IV. MOS transistors

8. MOS transistor.
9. CMOS transistors: applications.

Laboratory:

1. Experimental characterization of the diode and extraction of characteristic parameters.

2. Special diodes.

3. BJT transistors: Static Characteristic and Transfer Functions.

4. MOS transistors: Static Characteristic and Transfer Functions.

4. Academic activities

The distribution, in terms of credits, of the different programmed activities is as follows:

- Theory classes, seminars and evaluative tests: 4 ECTS.
- Problem solving and case studies: 1 ECTS.
- Laboratory practices: 1 ECTS.

The planning of these learning activities is established according to the classrooms, schedules and dates programmed by the degree program.

5. Assessment system

1. Completion of a test consisting of the resolution of a series of theoretical-practical exercises on a date and place pre-established by the Faculty of Science. It will be graded out of 10 points, and it is necessary to obtain a minimum of 5 points.

It constitutes 80% of the final grade of the subject.

2. Completion of the laboratory practices, preparation of the corresponding reports and their delivery on the established dates. It will be graded out of 10 points, and it is necessary to obtain a minimum of 5 points. Reports not submitted on time will be graded with 0 points. It constitutes 20% of the final grade of the subject.

Passing the subject by means of a single global test: Students who have not passed the subject with the previous proposed activities may choose to take a theoretical-practical test, on a date established by the official calendar.

6. Sustainable Development Goals

4 - Quality Education
8 - Decent Work and Economic Growth