COURSE DATA

DATA SUBJECT

Code: 34875
Name: Electronic and photonic devices
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
1403 - Degree in Telematics Engineering	Escola Tècnica Superior d'Enginyeria	2	Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1403 - Degree in Telematics Engineering	Electronic and photonic components and circuits	BASIC

COORDINATION

LIBEROS MASCARELL ALEJANDRO

SUMMARY

This is a Basic Training course, part of the Electronic and Photonic Circuits and Components course, and should provide basic knowledge of electronic and photonic circuits and devices. The goal is for students to learn to understand electronic circuits and their devices, learn to apply different circuit design and resolution techniques, and use electronic devices in those circuits.

Specifically, this course has been designed to address the following learning outcomes:

- Understand the operation of basic electronic and photonic devices, as well as their characteristics and limitations.
- Know the different materials used to manufacture the devices, as well as their basic characteristics.
- Linearize the different devices and deduce their circuit equivalents to understand how a circuit works.
- Be able to recognize basic electronic and photonic components and circuits.
- Be able to analyze and design an electronic circuit, applying the various established techniques.
- Master the basic tools of digital logic and understand its basic circuits.

The course will describe devices from a perspective ranging from the device's interior to its macroscopic or output characteristics, including its equivalent circuits. To emphasize knowledge about device behavior,

different applications of these circuits will be discussed within the context of telecommunications engineering.

Apart from the purely theoretical content, the course will provide students with the general knowledge necessary to solve engineering problems. Problem-solving knowledge will be acquired in the course's problem-solving sessions, where students must find solutions to problems in which the approach requires obtaining several solutions prior to the final result.

Regarding the skills required by any engineer, the course provides the necessary knowledge to assemble basic circuits on laboratory boards. Providing students with the skills to search for components, interpret schematic circuits, assemble various devices with common nodes, take measurements using laboratory instrumentation on the circuits, represent a set of measurements in both tables and graphs, and finally, interpret the data obtained.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

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

OTHER REQUIREMENTS

The prior knowledge necessary to follow the course of the subject is that acquired in the mathematics subjects and in the Electronic Circuits subject that are taught during the first year. Algebraic calculation, Kirchhoff's laws and circuit resolution are of particular relevance. Therefore, it is recommended to have taken these subjects.

COMPETENCES / LEARNING OUTCOMES

1403 - Degree in Telematics Engineering

B4 - Understand and master the basic concepts of linear systems and the related functions and transforms, electric circuit theory, electronic circuits, physical principle of semiconductors and logic families, electronic and photonic devices, materials technology and their application to solve engineering problems.

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.

DESCRIPTION OF CONTENTS

0. Fundamentals and basic concepts of electronic circuits.

This is a reminder of the main concepts and skills acquired in the subject Electronic Circuits.
Electrical Fundamentals: Magnitudes and Units. Fundamental Laws. Electrical Circuits. Kirchoff's Laws.

1. Passive elements: Resistors, capacitors and inductors

The elements described in the title are covered, including physical principles, physical components and markings, etc. The potentiometer and some variable resistors are also introduced.

2. The PN union

Introduction to semiconductor materials. Intrinsic and doped semiconductor materials.
The PN junction with and without polarization. The polarized PN junction. Currents in the PN junction.
The static characteristic curve.
Applications of the rectifier diode. Diode models. Analysis and design of circuits with diodes.

3. Other types of diodes

Zener, varicap, LED, and Schottky diodes.
Applications. Diodes and power supplies. Models. Circuit analysis and design. Interpretation of data sheets.

4. The bipolar transistor

Historical context and principal uses of the transistor. PNP and NPN junctions. Operating regions. Parameters and characteristic curves of bipolar transistors. Analysis and design of bias networks. Applications. Bipolar transistor data sheets.

5. Unipolar transistors

Introduction to the principle of FET operation. MOSFET, characteristic curves and parameters. Analysis and design of bias networks. Applications. Unipolar transistor data sheets.

6. Photonic and optoelectronic devices

Light and the Photoelectric Effect. Devices and Applications: LEDs, Photodiodes, Phototransistors, Optocouplers, Photoresistors.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	30,00
Laboratory	20,00
Classroom practices	10,00
Total hours	**60,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Individual or group project	0,00
Independent study and work	25,00
Preparation of lessons	25,00
Preparation for assessment activities	40,00
Resolution of case studies	0,00
Total hours	**90,00**

TEACHING METHODOLOGY

TECHNICAL LECTURES.

The technical lectures are master classes. During the master class the lecturer will ask some questions to the students to monitor the student progress in its self-organised work previous to each class. The master class will be supported by animated slides to improve the understanding of the abstract concepts involved in the devices junctions. All the support material used in the lectures (slides, papers, web links, bibliography, etc), will be available for the student in the online application "Aula Virtual". Competencies G3 and B4 are worked.

PROBLEM CLASSES.

The problem classes will be held in the classroom with a smaller group of students that in the technical lectures. In the problem classes some of the more significant problems that appear in the Problem Sheet will be solved. The problems will be solved in the backboard by the professor or by the students. As in the technical lectures, all the teaching resources will be available in Aula Virtual. Competencies G4 and B4 are worked.

LABORATORY SESSIONS

The laboratory sessions will be held in the laboratories of the ETSE. During the first half an hour of each laboratory session, the professor will evaluate the student self-organised work about the contents of the scheduled session. This evaluation will be done through some short questions, time scheduled of 15 minutes, or through some individual questions to the students in those groups with fewer students. Competencies G3, G4, G5 and B4 are worked.

TUTORIALS

The students have a tutorial timetable to solve problems, doubts, work orientation, etc. The tutorial timetable is set at the beginning of the academic course. Competencies G3, G4, G5 and B4 are worked.

EVALUATION

Regarding the evaluation process, different dimensions of the teaching-learning process will be considered. Note that the evaluation is proposed as formative, that is, comments will be provided that favor the correction of aspects to be improved. Daily interaction between students and teachers, comments in the Aula Virtual or review sessions will be used for that purpose.

In both first and second call, the final grade (NF) responds to the evaluation instruments according to the following expression:

$$NF = Ex \cdot 0{,}35 + ExP \cdot 0{,}1 + T \cdot 0{,}15 + AyP \cdot 0{,}05 + LabEC \cdot 0{,}14 + LabEx \cdot 0{,}21$$

In any case, (1) NF will be equal to Ex if the result of Ex is less than 4/10, (2) NF will be equal to LabEx if the result of LabEx is less than 4/10.

The different evaluation instruments are described below:

Ex: Exam. This is an individual objective test. It may contain both short questions, as well as the development of theoretical-practical questions, problems, etc. Any aspect presented during the course can be questioned. New problems related to the subject may also appear, as this is considered a useful methodology to assess the consolidation of competencies and content. This test will be carried out according to the ETSE exam calendar, Ex1 corresponds to the first call and Ex2 to the second.
Participation in Ex2 will be mandatory if the subject is not passed in the first call, otherwise the grade in the second call will be Not Presented. Any exception in this regard must be authorized by the teacher.

ExP: Midterm exam. During the course and during class hours, a test will be carried out to evaluate the consolidation of content and competences, as well as to give students the opportunity to face exercises like those that can be found in the Exam. The contents applicable to said test, as well as the rules to follow

and the date will be communicated during the course. This test will not reduce contents for the Exam.

T: Tasks. During the course, different assignments will be proposed both for their completion in the classroom and in a non-face-to-face manner. These assignments can be proposed to be completed individually or, preferably, in a team. In the team variant, coordination between different members of a team, the discussion to reach consensus solutions, etc. will be worked on these tasks. Peer and continuous assessment techniques may be used to differentiate the grades of different members of a team. Tasks delivered after the deadline will not be considered.

AyP: Attendance and participation. The contents and competences worked on during the course often exceed the specific exercises and problems of the objective tests. Therefore, attendance and participation of students throughout the course is required to achieve the highest grade. Teachers will be able to use different techniques to assess attendance, and participation during the theory or problem sessions.

LabEC: Continuous evaluation of laboratories. Each lab session will have a note associated. The degree of achievement, autonomy, and ability to interpret the results will be evaluated. In addition, each session may have associated preparation tasks that can constitute up to a fourth of the mark for each practice. LabEC will be calculated as the average between the marks obtained in each session. Attendance is mandatory to have a note associated with the session.
Unjustified non-attendance at the laboratory may be penalized beyond a 0 in the corresponding practice.

LabEx: Laboratory examination. The students will undergo an individual laboratory examination with exercises similar to those carried out at the lab sessions. LabEx1 corresponds to the first call, its date of completion will be indicated during the course. LabEx2 corresponds to the second call and will be held on the official date designated by the ETSE.
Participation in LabEx2 will be mandatory for students who have not achieved a grade higher than 4/10 in LabEx1. Voluntary participation in LabEx2 must be authorized by the teachers.

Attending to the minimum grades indicated above, the subject can be passed if (Ex·0.65 + LabEC·0.14 + LabEx·0.21) or (Ex·0.65 + LabEx·0.35) are greater than or equal to 5.

Copying or plagiarism of any activity that is part of the evaluation will result in the impossibility of passing the course, and the student will then be subject to the appropriate disciplinary procedures indicated in the ACTION PROTOCOL FOR FRAUDULENT PRACTICES AT THE UNIVERSITY OF VALENCIA (ACGUV 123/2020).

In any case, the evaluation system will be governed by what is established in the Evaluation and Qualification Regulations of Universitat de València for Bachelor's and Master's degrees. (http://www.uv.es/graus/normatives/2017_108_Reglament_avaluacio_qualificacio.pdf).

REFERENCES

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- Semiconductor Devices. Physics and Technology. S.M. Sze. Ed. John Wiley & Sons 1985, ISBN 0-471-87424-8.
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