Universidad de Alcalá

TEACHING GUIDE

Electronic Technology

Degree in
Telecommunication Technologies Engineering

Universidad de Alcalá

Academic Year 2025/2026

4th Year - 2nd Semester

Approved by the EPS School Board on June 16th, 2025

TEACHING GUIDE

Course Name:	**Electronic Technology**
Code:	**350046**
Degree in:	**Telecommunication Technologies Engineering**
Department and area:	**Electrónica** **Electronic Technology**
Type:	**Optional (Specialized)**
ECTS Credits:	**6.0**
Year and semester:	**4th Year, 2nd Semester**
Teachers:	Ana Jiménez Martín
Tutoring schedule:	Check website: http://www.depeca.uah.es
Language:	Spanish/English friendly

1. COURSE SUMMARY

The subject of Electronic Technology is an optional 6 ECTS course included in the second semester-fourth year of the Engineering Degrees on Telecommunication technologies. It aims to introduce students in the study and design of circuits from the lowest level. The topics covered include an introduction to the physics, and the mathematical models necessary to understand the operation of conventional semiconductor devices: PN-junction, bipolar junction transistors, and MOS transistors, and introduces semiconductor devices for systems for image acquisition and their presentation. Laboratory gives practical experience in printed circuit manufacturing process.

In order to be able to benefit from this module students must have studied Fundamentals of Electronics and Physics I and II.

2. SKILLS

Basic, Generic and Cross Curricular Skills.

This course contributes to acquire the following generic skills, which are defined in the Section 3 of the Annex to the Orden CIN/352/2009:

en_TR2 - Knowledge of basic subjects and technologies that enables to learn new methods and technologies, as well as to provide versatility that allows adaptation to new situations.

en_TR8 - Capacity of working in a multidisciplinary and multilingual team and of communicating, both in spoken and written language, knowledge, procedures, results and ideas related to telecommunications and electronics.

Professional Skills

This course contributes to acquire the following professional skills, which are defined in the Section 5 of the Annex to the Orden CIN/352/2009:

en_CSE1 - Ability to build, operate and manage capture, transportation, representation, processing, storage, management and presentation of multimedia information systems, from the point of view of the electronic systems.

en_CSE3 - Ability to perform the specification, implementation, documentation and tuning of equipment and systems, electronic, instrumentation and control, considering both the technical aspects and the corresponding regulatory regulations.

en_CSE4 - Ability to apply electronics as a support technology in other fields and activities, and not only in the field of Information and Communications Tecnology.

Learning Outcomes

The expected learning outcomes, expressed in the form of knowledge and skills and abilities that students should have achieved are as follows::

RA1. To describe and apply the basic principles of operation and use of semiconductor-based devices, such as diodes and transistors, so that they can correctly perform specifications and implementation of higher-level electronic systems.

RA2. To apply basic operating principles to specific devices based on electronic systems or multimedia information.

RA3. To describe the technologies used in the manufacture of printed circuits.

RA4. To use simulation software to design and modeling of manufacture of printed circuit boards.

RA5. To work effectively in a group for evaluating experimental results and writing technical lab reports from these results.

3. CONTENTS

Contents Blocks	Total number of hours*
Chapter 0. Introduction	1 hour
Chapter 1. Printed circuit board technology: Printed circuit technologies: SMT. Materials. Packaging. PCB manufacturing processes.	4 hours
Chapter 2. Semiconductor materials: electric conduction characteristics, band diagram.	8 hours
Chapter 3. Unión PN: structure, characteristics, Static and dynamic behaviour.	5 hours
Chapter 4. Bipolar Transistors: structure, characteristics, second order effects. Static and dynamic behaviour.	5 hours
Chapter 5. Field effectTransistors: JFET and MOSFET. structure, characteristics, second order effects. Static and dynamic behaviour.	7 hours
Chapter 6. Optoelectronic devices: Optical properties in semiconductors. Receivers devices. Emitter devices. Multimedia devices for image capture.	8 hours
Laboratory Session: Printed circuit board technology.	16 hours

* The time dedicated to solving problems are included in the total hours.

The timing and final course schedule will be adapted to the official calendar and will be described in a document available at the beginning of the term.

4. TEACHING - LEARNING METHODOLOGIES. FORMATIVE ACTIVITIES.

4.1. Credits Distribution

Number of on-site hours:	58 hours (54 hours on-site +4 exams hours)
Number of hours of student work:	92
Total hours	150

4.2. Methodological strategies, teaching materials and resources

In the teaching-learning process the following training activities will be carried out:

- **Theory classes** that allow to introduce the necessary knowledge for the correct development of

the learning process. Lectures will be based on a JITT (Just in time teaching) learning strategy that uses feedback between classroom activities and work that students do at home in advance. Classroom sessions will be carried out in large groups, encouraging inductive models based on the approach and resolution of problems through argumentation, discussion and group work.

- **Practical lectures** taught mostly in small groups based on solving exercises and problems. The aim of these classes is to promote meaningful learning that allows students to deepen their theoretical knowledge, relate and apply them creatively to solve more complex problems.
- **Practical laboratory classes**, exclusively taught in small groups based on problem or project solving.
- **Tutorials:** individual and group.

Along the course, students should make use of different sources and electronic or bibliographic resources, so that they will become acquainted with the future documentation environments they will use professionally. Additionally, the teaching staff will facilitate the materials for the module (theoretical, exercises and problems, practice manuals, visual references, etc.), so that students can meet the objectives of the course

The student may attend group and individual tutorials (if requested by the students) according to his/her needs and after agreement with the corresponding lecturers. Whether individually or in small groups, these tutorials will allow to solve the questions and consolidate the acquired knowledge. They also help to make an adequate monitoring and to evaluate the progress of the teaching-learning mechanisms.

Finally, the development of the course will be detailed in the course website. All materials produced for the course will be available (slides, set of exercises and solutions, problem statements for lab sessions, detailed schedules for each group and class, intermediate scores and all relevant information).

5. ASSESSMENT: procedures, evaluation and grading criteria

Preferably, students will be offered a continuous assessment model that has characteristics of formative assessment in a way that serves as feedback in the teaching-learning process.

5.1. PROCEDURES

The evaluation must be inspired by the criteria of continuous evaluation (Learning Assesment Guidelines, LAG, art 3). However, in compliance with the regulations of the University of Alcalá, an alternative process of final evaluation is made available to the student in accordance with the Learning Assesment Guidelines as indicated in Article 10, students will have a period of fifteen days from the start of the course to request in writing to the Director of the Polytechnic School their intention to take the non-continuous evaluation model adducing the reasons that they deem convenient. The evaluation of the learning process of all students who do not apply for it or are denied it will be done, by default, according to the continuous assessment model. The student has two calls to pass the subject, one ordinary and one extraordinary.

The continuous assessment tests have the following features:

- Allow the student to know, with real and objective evidence, what are the criteria of evaluation and qualification.
- Allow the student to know at regular intervals the results of the learning process and the acquired knowledge and skills.
- Provide to the teaching staff objective information on the development of the module.
- Do not reduce contents for the final test, since the purpose of such testing is to assess the overall acquisition of the skills of the module.

5.2. EVALUATION

EVALUATION CRITERIA

The evaluation process aims at assessing the degree and depth of the student's acquisition of the course skills previously described. Consequently, the evaluation criteria to be applied in the various tests that are part of the process, ensure that the student has the appropriate level in the following contents and skills:

CE1. Ability to describe the fundamental properties of semiconductor-based devices.

CE2. Ability to integrate the conceptual knowledge about the different devices to solve correctly and creatively specific problems.

CE3. Ability to model and simulate real systems for subsequent manufacturing on a printed circuit board, thought specific computer tools.

CE4. Ability to adequately document the theoretical and practical works carried out.

According to current regulations and considering that the experimental laboratory is essential for the acquisition of some course skills, attendance to all laboratory sessions is compulsory, as well as passing its evaluation, for both the ordinary and the extraordinary evaluation. For this reason, the attendance to all the laboratory lectures and evaluation are common and essential in the two types of evaluation: continuous and non-continuous.

GRADING TOOLS

The assessment criteria, as defined previously, apply to the following assessment tools.

- Assignments (**En**), exercises or theoretical-practical works proposed in class throughout the course.
- Lab practices and tests (**PL**), compulsory attendance. They are complementary to the theoretical part of the course.
- Global test (**PC**). It is based on a number of questions (theory and practice, analysis and / or synthesis) regarding to the specific aspects of all content covered by the course.
- Final test (**PEF**) It is based on a number of questions (theory and practice, analysis and / or synthesis) regarding to the specific aspects of all content covered by the course. This test will be done for those students whose option was final evaluation.

GRADING CRITERIA

In the **ordinary call-continuous assessment** the relationship between the competences, learning outcomes, criteria and evaluation instruments is as follows.

Skill	Learning Outcomes	Evaluation criteria	Grading Tool	Contribution to the final mark
TR8, CSE4	RA2, RA4, RA5	CE3, CE4	PL	30%
CSE1, CSE3, CSE4, TR2, TR8	RA1, RA2, RA3, RA5	CE1, CE2, CE4	E	30%
CSE1, CSE3, CSE4	RA1, RA2, RA3	CE1, CE2	PC	40%

According to the assessment criteria of the course, students are deemed to have passed the course (proving the acquisition of the theoretical and practical skills) if the following requirements are met:

- They should complete at least 80% of the tests and exercises commissioned during the course.

- They have successfully acquired the skills related to the laboratory assignment, according to criteria published in practice guides. It will be understood that a student acquires these competences satisfactorily if he attends the laboratory and his qualification in the set of the related tests is equal (or higher), to 50% of the maximum score.
- They have successfully acquired the skills related to the set of all tests and theoretical-practical assignments (if any) [En+PC]. It is understood that a student successfully acquire these skills, if their average score in all related assignments and tests is equal (or higher) to 50% of the maximum obtainable score.
- The score of the two previous parts should be at least 5 out of 10 to pass the module.

Students who follow the continuous assessment model, will be considered as not presented when they do not attend the global test (PC).

In the **ordinary call-final assessment**, the relationship between the competences, learning outcomes, criteria and evaluation instruments is as follows.

Skill	Learning Outcomes	Evaluation criteria	Grading Tool	Contribution to the final mark
CSE1, CSE3, CSE4, TR2	RA1, RA2, RA3	CE1, CE2	PEF	80%
TR8, CSE4	RA2, RA4, RA5	CE3, CE4	PL	20%

Extraordinary call

For all students, the extraordinary call will follow the guidelines set for the ordinary one in their final assessment model.

Those students who having failed the ordinary examination as a whole, if they have achieved a score equal to or greater than 4.5 out of 10 in one of the two parts of it, they could keep that mark in the extraordinary call.

The teaching-learning methodology and the assessment process will be adapted as needed, in accordance with the guidelines of the Diversity Support Unit, to implement curricular adaptations for students with specific needs.

6. BIBLIOGRAPHY

6.1. Basic Bibliography

Documentation generated by teachers for the course, which will be provided to students directly, or posted on the course Web site

Textbooks:

- Chenming Hu “Modern Semiconductor Devices for Integrated Circuits” Prentice Hall, 2010. http://www.eecs.berkeley.edu/~hu/
- J. Singh. “Dispositivos Semiconductores”. McGraw Hill, 1997
- S.M. Sze. “Semiconductor Devices. Physics and Technology”. John Wiley & Son. 1985
- Lluís Prat Viñas & Josep Calderer Cardona. “Dispositivos electrónicos y fotónicos. Fundamentos”. Ediciones UPC 2003
- J.M.Rabaey et al. "Circuitos Integrados Digitales"de Pearson Prentice Hall. 2ª Edición 2004
- José González Calabuig. “Circuitos Impresos: Diseño, teoría y montaje”. Ed. Paraninfo
- Robert J. Rowland. “Tecnología de montaje superficial aplicada”. Ed. Paraninfo

6.2. Additional Bibliography

- J.M. Albella, J.M. Martínez-Duart, F. Agulló-Rueda. "Fundamentos de microelectrónica, nanoelectrónica y fotónica", Prentice-Hall.
- M.N. Horenstein. “Microelectrónica: circuitos y dispositivos”. Prentice Hall.

Disclosure Note

During the evaluation tests, the guidelines set out in the Regulations establishing the Rules of Coexistence of the University of Alcalá must be followed, as well as the possible implications of the irregularities committed during said tests, including the consequences for committing academic fraud according to the Regulation of Disciplinary Regime of the Students of the University of Alcalá.