Course guide
820231 - TEEIA - Electronic Technology

Last modified: 04/06/2026

Unit in charge: Barcelona East School of Engineering
Teaching unit: 710 - EEL - Department of Electronic Engineering.

Degree: BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Compulsory subject).

Academic year: 2026 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: MANUEL ANDRÉS MANZANARES BROTONS

Others:

Primer quadrimestre:
LUIS LAGUNA ESTAÚN - Grup: M13, Grup: M14
MANUEL ANDRÉS MANZANARES BROTONS - Grup: M11, Grup: M12, Grup: M13, Grup: M14, Grup: M15, Grup: M16

Segon quadrimestre:
MANUEL ANDRÉS MANZANARES BROTONS - Grup: T11, Grup: T12, Grup: T13, Grup: T14

PRIOR SKILLS

The proper ones of the compulsory subjects of previous courses.

REQUIREMENTS

SISTEMES ELECTRÒNICS - Precorequisit

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CEEIA-20. Understand the fundamentals and applications of analogue electronics.
CEEIA-21. Understand the fundamentals and applications of digital electronics and microprocessors.
CEEIA-24. Design analogue, digital and power systems.

Transversal:
2. EFFECTIVE USE OF INFORMATI0N RESOURCES - Level 2. Designing and executing a good strategy for advanced searches using specialized information resources, once the various parts of an academic document have been identified and bibliographical references provided. Choosing suitable information based on its relevance and quality.

TEACHING METHODOLOGY

The methodologies used for the development of the course are the following ones:

- Master class with multimedia support in order to provide the student information in a synthesized and organized way. These lessons also intend proposes the autonomous study of some contents of the course in order to motivate the autonomous work when dealing with issues that are considered may be sufficiently interesting and motivating for students.

- Participatory expositive lessons so that students are not merely a passive element in the learning process. The teacher makes direct questions or suggests discussions at points that are considered of special importance or conceptual difficulty.

- Problem-based learning, which will be worked by themselves or in a group, in which the professor suggest the resolution of a collection of problems which will not be worked in the classroom so that the student can assess the degree of understanding of the subject.

- In the experimental laboratory sessions the methodology adopted is that of small cooperative groups in which students will acquire skills in the techniques of testing of electronic devices as well as in the interpretation of the information provided by the manufacturers devices.

LEARNING OBJECTIVES OF THE SUBJECT

To study the electronic devices (discrete and integrated), specifically in the following aspects:

1. To know the market and the state of the art.(Knowledge)
2. To know the different technologies used in its manufacture.(Knowledge)
3. To learn how to apply criteria so as to be able to select and use them. (Knowledge/Application)
4. To know their basic and advanced models and know their ranges of application in different electronic circuits. (Knowledge/Application)
5. To learn the basic concepts of their implementation in simulation software tools. (Knowledge/Application)
6. To learn how to perform the search, the selection and interpretation of technical documentation provided in English by the manufacturers of electronic devices (Knowledge/Comprehension/Application)
7. To learn how to perform laboratory tests relating related to its study and characterization. (Application/Analysis)

Other objectives of the subject are:

1. To consider concepts of environmental sustainability.(Knowledge)
2. The information resources management capacity provided by the different manufacturers of electronic devices.(Comprehension)

STUDY LOAD

Type	Hours	Percentage
Hours large group	45,0	30.00
Hours small group	15,0	10.00
Self study	90,0	60.00

Total learning time: 150 h

CONTENTS

1. Basic concepts.

Description:
Introduction to the study of materials: energy bands theory, types of materials and temperature effects. Reliability of components and systems. Linear and nonlinear components. Electronic datasheets: static and dynamic characteristics. Test and standards of electronic components. Introduction to the insertion and SMD packages.

Specific objectives:
At the end of this topic, the student will be capable of:

- Knowing the basics of the theory of energy bands and its application on the characterization of insulating, conductive and semiconductor components.
- Learning basic concepts of the theory of reliability applied to components and electronic equipment.
- Learning basic methods of modelling and analysis with nonlinear components.
- Analyzing the general basic structure of the datasheets offered by manufacturers and knowing some examples of tests applicable to the components and electronic equipment.
- Knowing the SMT technology as well as its advantages and disadvantages.

Related activities:
Problem solving sessions.
Out-of-class solving problems.
Laboratory Session: PCB's realization.
1. Photolitho's realization
2. PCB's obtaining.
3. PCB's assembly.
4. PCB's verification and testing.

Full-or-part-time: 21h
Theory classes: 6h
Laboratory classes: 2h
Self study : 13h

2. Analog devices.

Description:
Introduction to analog integrated circuits. Types of operational amplifiers. Internal structures and electric characteristics of real operational amplifier. Datasheets and devices selection. Other analog devices.

Specific objectives:
At the end of this topic, the student will be capable of:

- Having a global perspective of the integrated analog devices market.
- Knowing the different types of operational amplifiers on the market and understand the different basic internal structures.
- Analyzing the limitations of the real operational amplifier.
- Knowing how to interpret data from catalog and to acquire selection criteria of these devices available on the market.

Related activities:
Problem solving sessions.
Out-of-class solving problems.
Laboratory Session: Testing characteristics of operational amplifiers.
1. Input currents.
2. Offset voltage level.
3. Output voltage swing.
4. Slew rate.
5. Transition frequency.

Full-or-part-time: 20h
Theory classes: 6h
Laboratory classes: 2h
Self study : 12h

3. Semiconductor materials.

Description:
Definition and types of semiconductors. Carrier concentration. Carrier transport mechanisms. Band energy diagram. Industrial processes to obtain semiconductors materials. Industrial processes to doping semiconductor materials.

Specific objectives:
At the end of this topic, the student will be capable of:

- Knowing the different types of semiconductor materials used in the manufacture of electronic devices.
- Calculating the concentration of carriers in intrinsic and extrinsic semiconductors.
- Understanding the basic theory that defines the different carrier transport mechanisms present in semiconductor materials.
- Learning the various industrial processes for obtaining and doping semiconductor materials.

Related activities:
Problem solving sessions.
Out-of-class solving problems.

Full-or-part-time: 12h
Theory classes: 4h
Self study : 8h

4. Discrete semiconductors devices.

Description:
Diodes, BJT Transistors, FET transistors and power devices: internal structures manufacture, types, advanced models, influence of temperature, datasheets and packages. Comparison and selection of discrete devices. Application circuits with discrete devices. Thermal dissipation in the electronic devices: thermal resistance and thermal impedance, types of heatsinks and calculations.

Specific objectives:
At the end of this topic, the student will be capable of:

- Analyzing the internal electrical behaviour of diodes, transistors and power devices basic in order to establish an advanced model and be able to interpret the different data from datasheet.
- Knowing the internal structures manufacture of diodes, transistors and basic power devices.
- Learning to have selection criteria of discrete semiconductor devices for different circuits and applications.
- Defining different advanced models of these components, to learn how to establish their ranges of application and to know its possible use in simulation software tools.
- Understanding the influence of temperature on the variation of characteristics of these devices.
- Knowing how to interpret the different data from datasheet and recognizing about the different packages of these devices.
- Learning how to apply Ohm's thermal law in the calculation and selection of heatsinks for electronics devices in different working conditions.

Related activities:
Problem solving sessions.
Out-of-class solving problems.
Laboratory Session: Testing diodes and transistors.
1. Testing diodes.
2. Testing BJT transistors.
3. Testing MOSFET transistors.

Full-or-part-time: 34h
Theory classes: 11h
Laboratory classes: 2h
Self study : 21h

5. Digital devices.

Description:
Introduction to digital integrated circuits: development of logic families: subfamilies, internal structures and electric characteristics. Digital devices: evolution, types, design and manufacture.

Specific objectives:
At the end of this topic, the student will be capable of:

- Having a global perspective of the market of digital integrated devices.
- Knowing the technological evolution of digital integrated circuits from the logic families up to the current integrated circuits.
- Knowing about the technologies of manufacturing integrated circuits.
- Learning basic techniques of design of digital integrated circuits.

Related activities:
Problem solving sessions.
Out-of-class solving problems.
Laboratory Session: Testing characteristics of digital integrated circuits.
1. Input and output voltage levels.
2. Input currents.
3. Power supply currents.
4. Propagation times.

Full-or-part-time: 31h
Theory classes: 9h
Laboratory classes: 2h
Self study : 20h

6. Materials and components resistive, inductive and capacitive.

Description:
Conductor materials: electrical properties. Resistors: types, internal structure manufacture and advanced model device, datasheets and packages.
Dielectric materials: electrical properties. Capacitors: types, internal structure manufacture and advanced model device, datasheets and packages.
Magnetic materials: properties and types.
Inductors: types, advanced model device, commercial presentations of magnetic materials and inductors. Design conditions.

Specific objectives:
At the end of this topic, the student will be capable of:

- Knowing the electrical properties of the conductive materials, dielectric and magnetic materials.
- Selecting and recognizing the different types of resistors, capacitors and inductors present in the market.
- Knowing the internal manufactured structures of resistors, capacitors and inductors.
- Defining advanced models of resistors, capacitors and inductors and knowing their areas of application.
- Knowing how to interpret the datasheet and learning about the different packages of these components.

Related activities:
Problem solving sessions.
Out-of-class solving problems.
Laboratory Session: Tests of resistors, capacitors and inductors.
1. Testing resistors.
2. Testing capacitors.
3. Testing inductors.

Full-or-part-time: 20h
Theory classes: 6h
Laboratory classes: 2h
Self study : 12h

7. Optoelectronic devices.

Description:
Optoelectronic materials. Study models. Radiation effects in PN junction. Photoemitter and photogenerator devices. Photodetector devices. Energy capture: Solar cells. Optical fibers. Datasheets of optoelectronic devices. Optoelectronic devices selection.

Specific objectives:
At the end of this topic, the student will be capable of:

- Learning the physical principles and different basic models of behavior of the materials used in the manufacture of electronic devices.
- Differentiating the units used in radiometry and photometry.
- Analyzing the internal behavior of the optoelectronic devices.
- Knowing the specific possibilities of application of solar cells in power generation systems.
- Learning about the different types of optoelectronic devices on the market.
- Knowing how to interpret the catalog data and acquire selection criteria for these devices.

Related activities:
Laboratory Session: Testing characteristics of optoelectronic devices.
1. Testing of a general purpose component.
2. Testing of a logic optocoupler.

Full-or-part-time: 12h
Theory classes: 3h
Laboratory classes: 2h
Self study : 7h

GRADING SYSTEM

Any academic fraud, plagiarism or use or possession of unauthorised means in an assessment activity leads to a mark of zero (0) for the affected test or assignment. Furthermore, in accordance with the University's regulations, if disciplinary proceedings are initiated the subject is recorded as "Pending Assessment" until a decision is reached. These incidents are managed in accordance with the **Action Framework for Academic Integrity in Assessment at the UPC**.

Evaluation of specific competence:

During the course will be 2 continuous assessment tests, each of which will have a rating (NCP1, NCP2), and a final global exam (NCF) of the course contents.

Laboratory sessions mean a 20% of the mark and evaluate a part that corresponds to the work carried out in the laboratory, as well as a part that corresponds to the preparation prior to the development of the practice, so that the end of the semester students will get a rating of laboratory work, NLAB .

At the end of the semester the student will obtain the qualification of specific competence (NCE) as follows:

NCE = 0,2· NCP1 + 0,2 · NCP2 + 0,4· NCF + 0,2· NLAB

Evaluation of generic competence:

The assessment of generic competence will be based on direct assessment, the teacher and subject heading, generic competence Solvent Use of Information Resources (USRI), and based on a written work, giving place in the rating NCG.

Evaluation of the subject:

The final rating will be obtained from the results at the specific competence (NCE) and generic competence (NCG), according to the following algorithm:

NOTACURS = 0,9· NCE + 0,1· NCG

The pass mark in the subject may be obtained only if performed laboratory practices.

BIBLIOGRAPHY

Basic:
- Bragós Bardia, Ramon [et al.]. Circuitos y dispositivos electrónicos : fundamentos de electrónica [on line]. 6ª ed. Barcelona: Edicions UPC, 1999 [Consultation: 17/06/2020]. Available on: http://hdl.handle.net/2099.3/36340. ISBN 848301291X.
- Robles Viejo, Montserrat [et al.]. Física básica de semiconductores. Madrid: Paraninfo, 1993. ISBN 842832025X.
- Malik, Norbert R. Circuitos electrónicos : análisis, diseño y simulación. Madrid [etc.]: Prentice Hall, cop. 1996. ISBN 8489660034.

Complementary:
- Álvarez Santos, Ramiro. Materiales y componentes electrónicos activos. 6ª ed. Madrid: Ciencia3, 1992. ISBN 8486204410.
- Martínez García, Salvador. Prontuario para el diseño eléctrico y electrónico. Barcelona: Marcombo Boixareu, cop 1989. ISBN 8426707475.
- Pindado i Rico, Rafael. Electrónica analógica integrada : introducción al diseño mediante problemas. Barcelona: Marcombo-Boixareu Editores, DL 1997. ISBN 8426711081.

RESOURCES

Hyperlink:
- CAMPUS DIGITAL http://atenea.upc.edu. Available resources: "Transparencias de la asignatura" and "Colección de problemas".