1. OVERVIEW

Subject area	Electronic and Electrical Engineering
Degree	Bachelor's Degree in Industrial Organisation Engineering
School/Faculty	Faculty of Science, Engineering and Design
Year	Second
ECTS	6 ECTS
Type	Core
Language(s)	Spanish
Delivery Mode	On campus
Semester	1

2. INTRODUCTION

The subject area Principles of Electronic and Electrical Engineering is a compulsory component of any future industrial engineer's education. Electricity and electronics are involved in signal processing, which also include control systems.

Together with the physics previously learnt in Physics I and II, this subject deals with the physical concepts of how electrical devices work and the electrical components found in any industrial production system.

3. SKILLS AND LEARNING OUTCOMES

Basic skills (CB, by the acronym in Spanish):

- CB2 - Students can apply their knowledge to their work or vocation in a professional manner and possess the skills which are usually evident through the forming and defending of opinions and resolving problems within their study area.

- CB3 - Students have the ability to gather and interpret relevant data (usually within their study area) to form opinions which include reflecting on relevant social, scientific or ethical matters.

- CB4 - Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences.

- CB5 - Students have developed the learning skills necessary to undertake further study in a much more independent manner.

Cross-curricular skills (CT, by the acronym in Spanish):

- CT2: Independent learning: skills for choosing strategies to search, analyse, evaluate and manage information from different sources, as well as to independently learn and put into practice what has been learnt.

- CT3. Teamwork: ability to integrate and collaborate actively with other people, areas and/or organisations to reach common goals.

- CT4. Written/spoken communication: ability to communicate and gather information, ideas, opinions and viewpoints to understand and be able to act, spoken through words or gestures or written through words and/or graphic elements.

- CT5. Analysis and problem-solving: be able to critically assess information, break down complex situations, identify patterns and consider different alternatives, approaches and perspectives in order to find the best solutions and effective negotiations.

- CT8 - Entrepreneurial spirit: ability to take on and carry out activities that generate new opportunities, foresee problems or lead to improvements.

Specific skills (CE, by the acronym in Spanish):

- CE09 - Ability to use basic theory of circuits and electronic and electrical technology to solve problems in industrial projects and activity.

- CE10 - Ability to apply the foundations of automations and control systems to solve problems in industrial projects and activity.

Learning outcomes (RA, by the acronym in Spanish):

- RA1 - To pass the subject, students must show ability to suitably solve basic problems associated with electrical, electronic and automated engineering which may arise in engineering projects. These include analysis and design of electrical installations and electronic or automated systems.

Skills	Learning outcomes (RA, by the acronym in Spanish)
CB2, CB3, CB4, CB5, CT2, CT3, CT4, CT5, CT8, CE09, CE10	RA1: To pass the subject, students must show ability to suitably solve basic problems associated with electrical, electronic and automated engineering which may arise in engineering projects. These include analysis and design of electrical installations and electronic or automated systems.

4. CONTENTS

1. Electromagnetism and induction.
2. Basic electrical technology and equipment.
3. Basic electronic components.
4. Introduction to analogue and digital electronics.
5. Sensor and electronic control devices.

5. TEACHING/LEARNING METHODS

The types of teaching/learning methods are as follows:

- Collaborative learning: students learn to work with other people (colleagues and professors) to find creative, comprehensive and constructive solutions to questions and problems that arise from the given case studies, using relevant knowledge and available resources in relation to each subject.

- Laboratory classes where students can perform experiments to test the theoretical principles in safe surroundings.

- Problem/project-based learning: students face problems they must solve either working as a team or independently.

- Master Lecture: presentations by the professor using the appropriate technological tools to facilitate understanding of the subject matter.

- Gamification: use game-style activities to help problem-solving by means of computer programs so the learning process is easier for students.

- Case studies. Dealing with real-life situations in the field of engineering to which different solutions can be applied, with students having to defend their choices.

- Field work. Students visit local companies to learn about the normal day-to-day activity of a business.

6. LEARNING ACTIVITIES

The types of learning activities, plus the amount of time spent on each activity, are as follows:

Learning activity	Number of hours
Master lectures and practical seminars	25
Problem-solving	17
Case studies and field studies	6
Laboratory work	16
Debates and discussions	8
Learning contract (definition of interests, needs and objectives)	2
Autonomous learning	64
Tutorials	10
Knowledge tests	2
TOTAL	**150**

7. ASSESSMENT

The assessment systems, plus their weighting in the final grade for the subject area, are as follows:

Assessment system	Weighting
On campus knowledge tests, either theoretical or practical	50%
Off-site assessment tests. Case studies and problem-solving to assess theory and practical learning.	30%
Attitude assessment tests (attitude assessment rubrics, class participation)	10%
Self- and co-assessment	10%

On the Virtual Campus, when you open the subject area, you can see all the details of your assessment activities and the deadlines and assessment procedures for each activity.

8. BIBLIOGRAPHY

The reference publication to accompany this subject area is:

- Circuitos eléctricos, J.A. Edminister, Schaum, McGraw-Hill, Madrid.
- Circuitos eléctricos, Jesús Fraile Mora.
- Electromagnetismo y circuitos eléctricos, J. Fraile Mora, McGraw-Hill, Madrid.
- Operational amplifiers and linear integrated circuits: theory and applications. D.J. Dailey. McGraw Hill.
- Electrónica básica para ingenieros, G.A. Ruiz, Servicio de Publicaciones de la Universidad de Cantabria.
- Fundamentals of microelectronics. B. Razavi, 1st Ed. Wiley.
- Microelectronic circuits, A.S. Sedra & K.C. Smith. Oxford University Press.

  Chip design for submicron VLSI: CMOS layout and simulation, J.P. Uyemura. Thompson
- Lecciones de Física, Tomo III. José Luis Manglano
- Análisis de circuitos en ingeniería. William H. Hayt, Jr Jack E. Kemmerly, Steven M. Durbin