

## SUBJECT TEACHING GUIDE

G740 - Electronics

Degree in Mechanical Engineering

Academic year 2024-2025

| 1. IDENTIFYING DATA              |   |                  |                    |                  |                    |
|----------------------------------|---|------------------|--------------------|------------------|--------------------|
| Degree                           | Degree in Mechanical Engineering  |                  |                    | Type and Year    | Compulsory. Year 2 |
| Faculty                          | School of Industrial Engineering and Telecommunications   |                  |                    |                  |                    |
| Discipline                       | Subject Area: Electronics and Automation<br>Module in Common with the Industrial Branch   |                  |                    |                  |                    |
| Course unit title and code       | G740 - Electronics  |                  |                    |                  |                    |
| Number of ECTS credits allocated | 6   | Term             | Semester based (2) |                  |                    |
| Web                              | <a href="https://moodle.unican.es/course/view.php?idnumber=G740_2324">https://moodle.unican.es/course/view.php?idnumber=G740_2324</a> |                  |                    |                  |                    |
| Language of instruction          | Spanish   | English Friendly | Yes                | Mode of delivery | Face-to-face       |

|                  |   |  |  |  |  |
|------------------|---|--|--|--|--|
| Department       | DPTO. TECNOLOGIA ELECTRONICA E INGENIERIA DE SISTEMAS Y AUTOMATICA                              |  |  |  |  |
| Name of lecturer | YOLANDA LECHUGA SOLAEGUI  |  |  |  |  |
| E-mail           | yolanda.lechuga@unican.es   |  |  |  |  |
| Office           | E.T.S. de Ingenieros Industriales y de Telecomunicación. Planta: - 3. DESPACHO PROFESOR (S3082) |  |  |  |  |
| Other lecturers  |   |  |  |  |  |

| 3.1 LEARNING OUTCOMES  |
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| - Abilities for the use of passive components                  |
| - Abilities for the use of electronic instruments              |
| - Abilities for the analysis and design of electronic circuits |

**4. OBJECTIVES**

Introducing the fundamentals of analog and digital electronics. Learning to analyze and to design basic analog and digital circuits

Acquiring experience in using laboratory elements and electronic instruments

Acquiring experience in designing electronic circuits and acquiring the ability to read experimental data.

Development of the abilities to propose electronic-based solutions applied to the specifications of the industrial engineering

**6. SUBJECT PROGRAM**

CONTENTS

|   |   |
|---|---|
| 1 | Digital Electronics:<br>- Digital vs. Analog<br>- Combinational Logic: Boole's Algebra, truth tables, minimization, logic operations and memory cells.  |
| 2 | Introduction to semiconductors and active devices (diodes and transistors):<br>Characteristics of the PN junction. Junction diode and Zener diode. Structure and physical operation of MOS transistors. Current-voltage characteristics. Small-signal models                          |
| 3 | Sequential Logic:<br>- Memory elements and programmable systems<br>- Introduction to sequential circuits, PAL, PLAs, FPGAs  |
| 4 | Introduction and basic laws for electronic circuits:<br>Notation. Ohm's Law and Kirchoff's Laws. Shunt and series connection. Voltage and current dividers. Passive components: capacitors and inductances.   |
| 5 | MOS Amplifiers:<br>Biasing and basic single-stage configurations  |
| 6 | Operational Amplifiers:<br>Ideal OpAmps, real OpAmps. Inverting and Non-inverting amplifier. Summer and difference amplifiers. Integrator, differentiator. Comparator.  |
| 7 | Circuits with diodes:<br>Diode models and analysis of circuits with diodes.   |
| 8 | Filters and analog-to-digital converters:<br>- Filters: First and second-order filters. Design of low-pass, high-pass, bandpass and bandstop filters.<br>- Analog-to-digital conversion: Digital signal processing. Signal sampling and quantization. Conversion methods A/D and D/A. |

| 7. ASSESSMENT METHODS AND CRITERIA  |                       |             |           |        |
|---|-----------------------|-------------|-----------|--------|
| Description   | Type                  | Final Eval. | Reassessn | %      |
| Exam for Block 2  | Written exam          | Yes         | Yes       | 30,00  |
| Hands-on lab sessions   | Laboratory evaluation | No          | Yes       | 30,00  |
| Ongoing assessment  | Others                | No          | Yes       | 10,00  |
| Exam for Block 1  | Written exam          | Yes         | Yes       | 30,00  |
| TOTAL   |                       |             |           | 100,00 |
| Observations  |                       |             |           |        |
| <p>In order to pass the course, it is essential to pass the lab program.</p> <p>The grade for the course in the ordinary call will be obtained as a weighted average of the grades achieved in the evaluation activities.</p> <p>In the extraordinary call, the ongoing assessment and the exam for Block 1 can be overcome by adding their percentages to the weight of a final written exam.</p> <p>The laboratory program may be overcome by means of a practice exam that will take place in an extraordinary call.</p> <p>In case the sanitary conditions required it, the assessment will move from a presence-based to a virtually-supported modality, according to a mixed teaching format or, in the most extreme case where the presence-based activities were discouraged, these will be developed by telematic means through the virtual classroom ( Aula Virtual – Moodle), email, Microsoft Teams and/or any tool provided or allowed by the University of Cantabria for the assessment, or to guarantee the validity of the exams.</p> <p>The relative weights for each activity included in the assessment method of the course are maintained for all the described teaching modalities.</p> <p>Thus, the students must have a computer with a webcam and a microphone, or a smartphone with a built-in camera, internet connection, Microsoft Teams and/or any tool provided or allowed by the University of Cantabria.</p> |                       |             |           |        |
| Observations for part-time students   |                       |             |           |        |
| <p>For those students with part-time enrollment who cannot attend the scheduled lab sessions for justifiably reasons, the lab program could be passed by a separate practical exam that will take place at the ordinary evaluation call.</p>  |                       |             |           |        |

| 8. BIBLIOGRAPHY AND TEACHING MATERIALS  |
|---|
| BASIC   |
| Sedra A.S., Smith K.C., 2006. Circuitos Microelectrónicos (5ª Ed). McGraw Hill ISBN 9789701054727.        |
| Katz R.H., Borriello G. , 2005. Contemporary Logic Design (2nd Ed). Pearson Education ISBN 9780201308570. |