

COURSE GUIDE

2025/26

Faculty	345 - Faculty of Engineering - Bilbao	Cycle	.
Degree	GTELEC30 - Bachelor's Degree in Telecommunications Engineering	Year	Third year

COURSE

27387 - Digital Systems	Credits, ECTS:	6
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COURSE DESCRIPTION

In the "Digital Systems" course is expected that student learn the basic operation of electronic processors and design functional digital medium complexity systems based on these devices.

The course has a practical approach, so much of it will be taught through the use of laboratories.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

This subject basically develops skills 1 and 9 of the common module of the telecommunication branch (M02R1 and M02R9), referring to the use of digital circuits and microprocessors:

- 1. Ability to learn independently new knowledge and techniques suitable for the design, development or operation of telecommunication systems and services.
- 9. Ability to analyze and design combinational and sequential circuits, synchronous and asynchronous, and use of microprocessors and integrated circuits.

Specifically, to develop the established skills, it is intended that students:

- 1. Know the basic operation of the processors from the point of view of digital electronic machine.
- 2. Know some of the microprocessors and microcontrollers used today.
- 3. Know the different circuits and subsystems used together with the processors to constitute a system.
- 4. Design systems based on microprocessors and microcontrollers suitable for certain technical requirements.
- 5. Learn basic microprocessor and microcontroller programming techniques, especially those referring to state machines, event machines and time machines.
- 6. Learn the appropriate ways of documenting the technical information required for digital systems projects.

Theoretical and Practical Contents

- 1. Laboratory knowledge: Familiarization with laboratory equipment, assembly of small digital systems, identification of components.
- 2. Introduction: Processing system architectures, basic processor parts (memory, ports, interrupts).
- 3. Central processing unit: Operation of a processor, instructions, assembler programs, operating clock, reset circuits, auto-reset or watchdog.
- 4. Memory: Definition of memories, memory types, memory maps, memory paging, memory segmentation, memory interface with processors, synchronous buses, asynchronous and wait cycles.
- 5. Software development: flowcharts, subroutines and step parameters, state machines and events.
- 6. Peripherals: I / O ports, keyboards, screens, timers, communications ports.
- 7. Interrupts: Types of interrupt requests, techniques used for interrupt service routines, time machines.

TEACHING METHODS

The methodology to be used includes a series of lectures where the most relevant concepts of the subject are explained. In the practical classes the students receive some explanations to focus the mentioned concepts to the particular system used for the practices.

Depending on the academic schedule, some laboratory classes may be changed by an extension in the time of the lectures.

Depending on the academic schedule, some laboratory classes may be changed by seminars.

In the event that sanitary conditions prevent the carrying out a teaching activity and / or face-to-face assessment, will activate a remote modality from which the students will be informed promptly.

TYPES OF TEACHING

Types of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Hours of face-to-face teaching			15	45					
Horas de Actividad No Presencial del Alumno/a			22,5	67,5					

Legend:

M: Lecture-based
GL: Applied laboratory-based groups
TA: Workshop

S: Seminar
GO: Applied computer-based groups
TI: Industrial workshop

GA: Applied classroom-based groups
GCL: Applied clinical-based groups
GCA: Applied fieldwork groups

Evaluation methods

- Continuous evaluation
- End-of-course evaluation

Evaluation tools and percentages of final mark

- Written test, open questions 60%
- Teamwork assignments (problem solving, Project design) 30%
- Occasional tests / quizzes 10%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The evaluation of the subject during the course is carried out as follows:

40% Continuous evaluation that will be composed of 30% evaluated in laboratory practices and 10% in eventual evaluations.

60% Written exam of the subject in the official call.

Waiver of continuous evaluation (40%) will be made in the first 9 weeks of the course. In this case, 40% of the continuous evaluation will be obtained in a practical exam additional to the written exam of the ordinary call.

To pass the subject, it is essential to pass both the continuous evaluation and the written evaluation separately.

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

In the extraordinary call, the student can choose to take a 60% written exam, maintaining the marks obtained in the continuous evaluation, or to be examined with a general written exam of 60% and an additional 40% laboratory exam.

To pass the subject, it is essential to pass both the laboratory exam and the written exam separately.

MANDATORY MATERIALS

1. A. Zuloaga, E. Basabe, "Notes on Digital Systems". Publications of the School of Engineering of Bilbao.*
2. A. Zuloaga. "Digital systems laboratory". Publications of the School of Engineering of Bilbao.*
3. Kit of the Pictor development platform.

* Available at eGela platform

BIBLIOGRAPHY

Basic bibliography

In English:

1. Microchip Technology. MPASM Assembler, MPLINK Object Linker, MPLIB Object Librarian User's Guide. 2012.
<http://ww1.microchip.com/downloads/en/DeviceDoc/33014L.pdf>
2. Microchip Technology. PIC16F882/883/884/886/887 Data Sheet. 2009
<http://ww1.microchip.com/downloads/en/devicedoc/41291f.pdf>
3. T. Wilmshurst. Designing embedded systems with PIC microcontrollers. Elsevier. Oxford, UK 2007
<https://www.elsevier.com/books/designing-embedded-systems-with-pic-microcontrollers/wilmshurst/978-1-85617-750-4>

In Spanish:

1. A. Zuloaga, A. Astarloa, "Sistemas de procesamiento digital", Delta Publicaciones, 2007
2. A. Zuloaga, "Apuntes de Sistemas Digitales", Publications of the School of Engineering of Bilbao.*
3. A. Zuloaga, "Conociendo los procesadores con el sistema Pictor", 2022

* Available at eGela platform.

Detailed bibliography

1. P. de Miguel,"Fundamentos de los computadores", Paraninfo 2001.

Journals

Web sites of interest

OBSERVATIONS

In the event that sanitary conditions prevent the carrying out a teaching activity and / or face-to-face assessment, will activate a remote modality from which the students will be informed promptly.