COURSE DATA

DATA SUBJECT

Code: 34824
Name: Integrated telecommunication systems
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2026-27

STUDY (S)

Degree	Center	Acad. year	Period
1402 - Degree in Telecommunications Electronic Engineering	Escola Tècnica Superior d'Enginyeria	4	Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1402 - Degree in Telecommunications Electronic Engineering	Optional subjects	ELECTIVES

COORDINATION

SUAREZ ZAPATA ADRIAN

TORRES PAIS JOSE GABRIEL

SUMMARY

The course Integrated Systems in Telecommunications is an optional, semester-based course taught in the fourth year of the Bachelor's Degree in Telecommunications Electronic Engineering, during the second semester. The course carries a total of 6 ECTS credits in the curriculum.

The course is related to the subject area of Digital Electronic Systems and its general aim is to build on the techniques for the analysis and synthesis of digital systems already known by students, moving towards the hardware-software co-design of embedded computational systems aimed at the development of products and applications in the field of telecommunications.

The main activities of the course include the study of methodologies for designing microcontroller-based systems, both at firmware and hardware level; practice with programming languages and models, especially the C language; and the learning of basic guidelines for developing efficient, maintainable and reusable firmware.

Likewise, students will work with a professional design platform, paying attention to the aspects that help

improve productivity in the development of integrated systems. The course also covers contents related to programmable devices and their applications, such as hardware-software co-design, analogue-digital fusion, visual programming, real-time applications, protocol design, integrated communications, multiprocessor systems on programmable system-on-chip platforms, Bluetooth, IoT and real-time operating systems.

The teaching methodology is mainly practical and is based on the planned development of course designs and projects. Classes will combine theoretical foundations with their practical application, encouraging students' active participation and teamwork. In addition, topics of interest may be addressed through technical seminars.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

There are no specified enrollment restrictions with other subjects of the curriculum.

OTHER REQUIREMENTS

In order to take full advantage of the course, students are recommended to have previously acquired basic knowledge of Digital Electronic Systems. It is also advisable to have prior programming knowledge acquired in the Computer Science subject.

COMPETENCES / LEARNING OUTCOMES

DESCRIPTION OF CONTENTS

1. Introduction to Integrated Telecommunications Systems

¿ Integrated System Concept.
¿ Characteristics of an Integrated System.
¿ Examples of Integrated Systems currently in existence.

2. Architecture of a Programmable System on Chip (PSoC)

¿ Internal structure of a PSoC
¿ Main features of a PSoC
¿ Comparison between the different families of PSoCs

3. Design flow with PSoC Creator

¿ Introduction to the PSoC Creator design and programming platform
¿ Hardware-firmware co-design
¿ My First Program with PSoC Creator.

4. PSoC device resources

¿ Power system
¿ Memory characteristics
¿ System clock management
¿ Timers Management
¿ GPIOs
¿ Interruptions

5. Digital peripherals and integrated digital communications

¿ Universal digital blocks (UDB)
¿ PWM control
¿ Serial communication (UART)
¿ SPI communication
¿ I2C communication

6. Analog peripherals and sensor management

¿ Delta-sigma converters (ADCs)
¿ Integrated operational amplifiers
¿ Comparators
¿ DACs

7. Bluetooth and IoT communication

¿ Features of the Bluetooth protocol
¿ Description of the BLE component in PSoC Creator
¿ Internet of Things (IoT) description and features

8. Introduction to real-time operating systems (RTOS)

¿ RTOS concept
¿ PSRC FreeRTOS
¿ Description of an application run on a FreeRTOS with PSoC

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	40,00
Laboratory	20,00
Total hours	**60,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	4,00
Individual or group project	16,00
Independent study and work	20,00
Preparation of lessons	40,00
Preparation for assessment activities	2,00
Resolution of case studies	8,00
Total hours	**90,00**

TEACHING METHODOLOGY

The course training activities will be organised by combining theoretical sessions, experimental sessions, autonomous work, assessment activities and tutorials. The methodology will have a mainly practical approach and will be aimed at the progressive development of competences related to the design, programming and validation of integrated systems in telecommunications.

a) Theoretical activities.

In theoretical classes, the course contents will be developed by providing a global and integrated overview of each topic and by analysing in greater detail the key or more complex aspects.

These sessions will be aimed at facilitating the understanding of the fundamental concepts and their subsequent application in practical and experimental activities. Active student participation will be encouraged through questions, examples and cases related to integrated systems and programmable platforms.

b) Experimental activities.

The experimental activities will complement the theoretical contents and will allow the concepts studied to be applied to practical cases involving the design, programming and validation of microcontroller-based systems.

These sessions will preferably be carried out in groups, with the aim of promoting collaborative work, technical problem-solving and the acquisition of practical laboratory skills. They will include activities

related to device configuration, firmware development, peripheral integration and communication between systems.

As part of these activities, students will develop a final mini-project in which they must apply the knowledge acquired to solve an application defined by the teaching team. The mini-project will be carried out using a PSoC-based platform, which must be programmed and validated to meet specific requirements.

c) Autonomous student work.

Autonomous work will include the preparation of theoretical classes, the review of materials, the preparation of experimental sessions, personal study, the completion of tasks and the preparation of assessment tests.

This work will help consolidate the course contents and promote students' autonomy in the analysis, design and implementation of technical solutions.

d) Assessment.

Assessment will be carried out in accordance with the systems, weightings and requirements established in the corresponding section of the course guide.

Assessment will take into account both the monitoring of the activities carried out during the course and the acquisition of the learning outcomes associated with the theoretical, practical and laboratory contents.

e) Tutorials.

Tutorials may be held individually or in groups, and their aim will be to guide students' work, resolve doubts, review the development of activities and facilitate the monitoring of the learning process.

Students may raise questions related to the theoretical contents, experimental activities, the mini-project or any other academic aspect linked to the course.

EVALUATION

The assessment of the course will be carried out through continuous assessment in the first call and through recovery assessment tests in the second call.

FIRST CALL

In the first call, the final mark will be obtained through the following components:

1. Continuous assessment, 30%.
This component will be assessed on the basis of attendance and active participation in the experimental sessions, as well as the review and grading of the activities and tasks carried out during those sessions.
In the second call, the recovery of this component will be integrated into the examination on theoretical and practical contents, which will account for 60% of the final mark.
2. Assessment of a mini-project, 40%.
The mini-project will be carried out in groups and will be assessed through its presentation, defence and functional demonstration during the final sessions of the course. In order to be assessed in this component in the first call, students must attend at least 80% of the laboratory sessions linked to the development of the mini-project.
If this component is not passed in the first call, it may be recovered in the second call by means of a specific practical test, accounting for 40% of the final mark, consisting of programming the PSoC development kit to meet specific requirements.
3. Examination on theoretical and practical contents, 30%.
This examination will consist of answering theoretical and practical questions based on the contents, activities and developments carried out during the course.
In order to pass the course in the first call, students must obtain a minimum mark of 4 out of 10 in both the mini-project and the examination on theoretical and practical contents. The final mark will be the weighted sum of the three components described above, and students must obtain at least 5 out of 10 to pass the course.

SECOND CALL

In the second call, the final mark will be obtained through the following components:

1. Examination on theoretical and practical contents, 60%.
This objective test replaces the "Continuous assessment" and "Examination on theoretical and practical contents" components of the first call. Therefore, the mark obtained in the "Continuous assessment" component will not be retained, as its recovery is integrated into this examination.
2. Practical recovery test for the mini-project, 40%.
This test corresponds to the assessment of laboratory activities and must only be taken if the mini-project was not passed in the first call. If this component was passed in the first call, the mark obtained will be retained.
In order to pass the course in the second call, students must obtain a minimum mark of 4 out of 10 in each of the tests they are required to take and a final minimum mark of 5 out of 10. The final mark will be the weighted sum of the marks obtained in the corresponding components.

APPLICABLE REGULATIONS

In any case, the assessment system will be governed by the provisions of the Regulations on Assessment and Grading of the Universitat de València for Bachelor's and Master's Degrees (https://webges.uv.es/uvTaeWeb/MuestraInformacionEdictoPublicoFrontAction.do?accion=inicio&idEdictoSeleccionado=5639). Any clear case of copying or plagiarism in any activity forming part of the assessment will result in the impossibility of passing the course, and the corresponding disciplinary procedures set out in the PROTOCOL FOR ACTION AGAINST FRAUDULENT PRACTICES AT THE UNIVERSITAT DE VALÈNCIA (ACGUV 123/2020) will subsequently be applied.

REFERENCES

- Wolf, W. "Computers as Components: Principles of Embedded Computing System Design". The Morgan Kaufmann Series in Computer Architecture and Design, 3º Ed. 2012. ISBN 0123884365
- Ashby, R. "Designer's Guide to the Cypress PSOC". Embedded Series. Ed. Newnes, 2005. ISBN 0750677805
- A. Dent and B. J. Blalock, "Mixed-signal Embedded Systems Design: A Hands-on Guide to the Cypress PSoC". Burlington, MA: Newnes, 2022.
- Pont, M. "Embedded C". ACM Press, Addison Wesley, 2002. ISBN 020179523X