UAB
Universitat Autònoma de Barcelona

Computer Architecture and Peripherals

2026/2027

Code: 107851
Credits: 6

Degree programme	Type	Course
Electronic Engineering for Telecommunications	OB	2
Telecommunication Systems Engineering	OB	2

Contact lecturer

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Group languages

You can consult this information at the end of the document.

Prerequisites

Although there are no formally established prerequisites, a good knowledge of the basic operation of a computer, digital systems and programming fundamentals is highly recommended. (Fundamentals of Computer Science, Digital Systems and C language).

Objectives

The basic objectives of the course are to provide students with an overall understanding of how computer systems operate, both general-purpose and embedded systems, and to develop initial skills in low-level programming. The course also aims to introduce the operation of peripherals, their connection and control mechanisms, and their programming using languages such as assembly language and C.

These objectives are developed through the following aspects:

- Understand the organization and basic operation of a general-purpose computer.
- Analyze the structure and operation of microcontroller-based embedded systems.
- Acquire fundamental skills in assembly language programming.
- Become familiar with the most common peripherals, their mechanisms of interaction with the processor, and their management through input/output (I/O) operations.
- Program and control I/O devices using low-level and high-level languages, especially assembly language and C.

Learning outcomes

Electronic Engineering for Telecommunications

- KU117 (Distinguish the fundamentals of hardware description languages.) Distinguish the fundamentals of hardware description languages.
- SU121 (Use the fundamentals of software design, verification and validation to describe hardware systems based on high-level hardware description languages.) Use the fundamentals of software design, verification and validation to describe hardware systems based on high-level hardware description languages.
- SU122 (Use computer tools to search for bibliographic resources or information related to telecommunications and electronics.) Use computer tools to search for bibliographic resources or information related to telecommunications and electronics.

Telecommunication Systems Engineering

- KU117 (Distinguish the fundamentals of hardware description languages.) Distinguish the fundamentals of hardware description languages.
- SU121 (Use the fundamentals of software design, verification and validation to describe hardware systems based on high-level hardware description languages.) Use the fundamentals of software design, verification and validation to describe hardware systems based on high-level hardware description languages.
- SU122 (Use computer tools to search for bibliographic resources or information related to telecommunications and electronics.) Use computer tools to search for bibliographic resources or information related to telecommunications and electronics.

Contents

1. Processor: Architecture and Operation

- Processor organization and basic performance analysis.
- Instruction set architecture (ISA). Assembly language programming.
- Datapath and instruction execution cycle.
- Pipelining.

2. Input/Output Systems and Peripheral Management

- I/O modules and controllers.
- Synchronization and transfer techniques with I/O devices.
- Peripherals and peripheral management.
- Connection and communication with I/O devices.

3. Memory System

- Memory characteristics and types.
- Memory organization.
- Memory hierarchy and locality principles.
- Cache memory and basic performance analysis.

4. Design of Microcontroller-Based Systems

- Internal organization of microcontrollers, integrated controllers, and external interface.
- Assembly language and C programming.
- Management of integrated controllers: GPIO, timers, interrupts, UART, I2C, etc.
- Development and debugging tools.

Learning activities and methodology

Title	Hours	ECTS	Learning outcomes
Preparing laboratory sessions	12	0.48	SU122
Preparing and solving exercises	30	1.2	SU122
Autonomous work	40	1.6	SU122
Face to face classes	35	1.4	KU117
Laboratory practices	10	0.4	SU121
Exercise-based classes	12	0.48	SU121

Lectures

The course content will be presented through lectures, in which the fundamental concepts of the syllabus will be introduced and guidance will be provided so that students can expand and deepen their understanding independently.

Although these sessions are mainly based on explanations by the teaching staff, active student participation will be encouraged through questions, examples, problems and exercises designed to check understanding of the material.

The exercises completed and submitted during these sessions may be taken into account in the assessment item "Periodic submission of exercises completed in class", provided that the grade obtained in each individual test is higher than 4.

Seminars

Seminars will help consolidate and deepen the knowledge presented in the lectures. To this end, activities such as problem-solving, analysis of practical cases and reasoned discussion of solutions will be carried out.

Cooperative learning and collaborative problem-solving methodologies will also be promoted. The exercises completed and submitted in the seminars may be included in the assessment item "Periodic submission of exercises completed in class", provided that the grade obtained in each test is higher than 4.

In addition, seminars will serve as a space for monitoring the practical work, guiding students on the knowledge required to develop it and on the resources available to acquire that knowledge.

Overall, seminars will act as a bridge between lectures and practical work, fostering analytical and synthesis skills, critical thinking and problem-solving.

Practical Sessions

Students will receive a dossier describing the practical work to be developed throughout the course. This work will focus on the design, implementation and testing of programs in assembly language and C, with the aim of understanding how a computer works and the mechanisms of the input/output subsystem.

Practical sessions will be carried out in groups and will take place in two-hour laboratory sessions. Attendance at practical sessions is compulsory; in order to pass this part of the course, students must attend at least five sessions. During the sessions, the proposed programs will be implemented, debugged and validated.

Supervised Activities

The ALUA Moodle virtual campus will be used as a tool to support teaching and interaction between teaching staff and students. This platform will provide access to materials, communication, activity monitoring and

assignment submission, where appropriate.

Educational Approach

The course methodology is aimed at promoting active and progressive learning. It will develop skills related to work organization and planning, oral and written communication, teamwork, analytical and synthesis skills, and critical thinking.

The quality of the work carried out, its presentation, the degree to which the proposed objectives are achieved and the correct functioning of the developed solutions will be assessed.

Note on Evaluation Surveys

15 minutes of one class session will be reserved, within the calendar established by the centre or degree programme, so that students can complete the surveys evaluating the teaching activity and the course or module.

Annotation: within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continuous assessment activities

Title	Weight	Hours	ECTS	Learning outcomes
Individual test 1: Processor and Instruction Set	24%	4	0.16	KU117, SU121
Individual test 2: Input / Output System and Memory System	36%	4	0.16	KU117, SU121
Periodic submission of exercises completed in class.	10%	0	0	SU121
Laboratory work	30%	2	0.08	SU121, SU122
Individual laboratory practical exam	10%	1	0.04	SU121

a) Assessment process and scheduled assessment activities

The course consists of the following assessment activities:

- Partial individual written theoretical tests, held in person, related to lectures and seminars: during the course, two individual written tests will be held in person. These tests are associated with the contents covered in lectures and seminars.

Individual Test 1: Processor and Instruction Set will account for 40% of the final theory grade, equivalent to 24% of the final course grade.

Individual Test 2: Input/Output Concepts and Memory System will account for 60% of the final theory grade, equivalent to 36% of the final course grade.

The final theory grade accounts for 60% of the total course grade.

In order to pass the course through continuous assessment, a grade equal to or higher than 4 must be obtained in each of these individual tests. In addition, the average final theory grade, calculated according to the indicated weights, must be equal to or higher than 5.

- Attendance and participation in face-to-face activities: laboratory practical sessions. In the laboratory

practical sessions, the knowledge acquired in lectures and seminars will be applied using a development board based on a microcontroller.

Laboratory practical sessions will account for 30% of the final course grade.

Attendance at laboratory practical sessions is compulsory. In order to pass this part of the course, students must attend the practical sessions in person. Only one absence may be justified for officially accredited reasons with respect to the total number of scheduled practical sessions. The absence must also be reported to the teaching staff responsible for the session, whenever possible before the session takes place. Accumulating more than one absence, even if one of them is justified, will prevent students from passing this part of the course.

Laboratory practical sessions are non-recoverable activities. In order to pass the course, the grade for the laboratory practical sessions must be equal to or higher than 5. Therefore, obtaining a grade lower than 5 in the practical sessions means that the course cannot be passed.

- Individual written in-person test on the laboratory practical sessions: an individual test on the laboratory practical sessions will be held, allowing the assessment of the knowledge and skills acquired during the practical sessions.

This test will account for 10% of the final course grade.

In order to pass the course, the grade for this test must be equal to or higher than 4. In addition, the overall grade for the practical component, consisting of the laboratory practical sessions and the individual test on practical sessions, must be equal to or higher than 5.

- Problem-solving activities, individually or in groups. During the course, short exercises will be proposed in lectures and seminars. These exercises will make it possible to monitor learning continuously and will be assessed under the item "Periodic submission of exercises completed in class", which accounts for 10% of the final course grade.

The Periodic submission of exercises completed in class is a conditional and non-compulsory continuous assessment activity. This grade will only be taken into account if the grade obtained in each individual test is higher than 4.

The Periodic submission of exercises completed in class is non-recoverable. Not completing or not passing this activity will not prevent students from obtaining the maximum course grade, provided that the remaining assessment requirements are met.

b) Scheduling of assessment activities

The schedule of assessment activities will be communicated at the beginning of the course. It will be published on the Virtual Campus and on the School of Engineering website, in the examinations section.

This schedule may be subject to changes due to teaching organisation reasons or incidents. Any change will be communicated in class and through the Virtual Campus.

c) Continuous assessment

In order to pass the course through continuous assessment, each of the previous items must be passed individually; that is, when the requirements are met, the final theory grade must be equal to or higher than 5, and the grade for the laboratory practical sessions and the practical test must be equal to or higher than 5.

d) Recovery process

Only students who have previously been assessed in a set of activities whose weight is equivalent to at least two thirds of the total course grade, and who have obtained a continuous assessment grade equal to or higher than 3.5, may sit the course recovery test.

If a grade of 5.0 is not achieved, the grade obtained in continuous assessment will be maintained.

In the recovery test, students must sit the partial theory tests in which they obtained a grade lower than 4 and/or the individual test on practical sessions if the grade obtained was lower than 4.

In order to pass the course through the recovery process, the grades of the partial theory tests, both those maintained from the continuous assessment process and those obtained in the recovery test, must be equal to or higher than 4. In addition, the final theory grade, calculated according to the established weights, must be equal to or higher than 5.

Likewise, the grade for the individual test on practical sessions obtained in the recovery test must be equal to or higher than 4, and the minimum requirements established for the practical component must be met. The maximum grade for the individual recovery test will be 7.

Laboratory practical sessions and the periodic submission of exercises completed in class are non-recoverable.

e) Grade review procedure

For each assessment activity, a place, date and time for review will be indicated. During this review, students may consult the assessed activity with the teaching staff.

During the review process, claims regarding the grade of the activity may be submitted and will be assessed by the teaching staff responsible for the course. If a student does not attend the review within the established period, the activity will not be reviewed afterwards.

f) Grades

The final course grade will be calculated according to the specified weights and taking into account the minimum requirements established for each assessment activity.

In order to calculate the final average, the minimum requirements for the individual tests, the laboratory practical sessions, the individual test on practical sessions and attendance at practical sessions must be met.

If the minimum required in any compulsory assessment activity is not reached, and the calculation of the final grade is equal to or higher than 4,5, the grade recorded in the academic transcript will be 4,5.

Honours grades (MH). Awarding an honours grade is a decision made by the teaching staff responsible for the course. UAB regulations state that honours grades may only be awarded to students who have obtained a final grade equal to or higher than 9.00. Up to 5% of honours grades may be awarded out of the total number of enrolled students.

A student will be considered not assessable (NA) if they have not taken part in any of the assessable activities of the course.

g) Irregularities by students, copying and plagiarism

Without prejudice to any other disciplinary measures deemed appropriate and in accordance with the current academic regulations, irregularities committed by students that may lead to a change in the grade of an assessment activity will be graded with zero.

Therefore, copying, allowing others to copy, plagiarising, cheating, etc., in any of the assessment activities will result in a grade of zero for the affected activity. If that activity is compulsory in order to pass the course, the course will be failed.

Assessment activities graded in this way and through this procedure will not be recoverable and, therefore, the course will be failed directly, without the possibility of recovery in the same academic year.

The use of artificial intelligence (AI) technologies is permitted as support in the development of work, provided that a significant contribution by the student is reflected in the analysis and personal reflection. It must be clearly indicated which parts have been generated using AI, which tools have been used, and a critical reflection must be provided on how they have influenced the process and the results. Lack of transparency in this use will be considered a breach of academic honesty and may lead to a grade penalty or other disciplinary measures.

h) Assessment of repeating students

As a general rule, no distinction is made between repeating and non-repeating students with regard to assessment. All students must follow the same system and meet the same requirements.

i) Single assessment

This course does not include the single assessment system.

Bibliography

- "Organización y Arquitectura de Computadores. Principios de estructura y funcionamiento" Stallings, William. Prentice Hall

- "Problemas resueltos de estructura de computadores". Felix García Carballeira.Paraninfo.

- "Computer Organization & Design. The hardware/software interface" David Patterson/John L. Hennessy. Ed. Morgan Kaufmann Publishers.

- "Digital Design and Computer Architecture, ARM Edition". Sarah Harris, David Harris. Morgan Kaufmann

- "Digital Design and Computer Architecture, RISC-V Edition". Sarah Harris, David Harris. Morgan Kaufmann

- Designing Embedded Hardware, 2nd Edition By John Catsoulis Publisher: O'Reilly Media Released: May 2005

-The Art of Readable Code Simple and Practical Techniques for Writing Better Code By Dustin Boswell, Trevor Foucher Publisher: O'Reilly Media Released: November 2011

-Designing Mobile Interfaces Patterns for Interaction Design By Steven Hoober, Eric Berkman Publisher: O'Reilly Media Released: November 2011

-Making Embedded Systems Design Patterns for Great Software By Elecia White Publisher: O'Reilly Medi Released: October 2011

- Joseph Yiu. (2011). The Definitive Guide to the ARM Cortex-M0 Elsevier. / Yiu, Joseph, Llibre en línia

Software

Code Warrior (FRDM-KL25Z)

Compilador de C (gcc)

Ensamblador (ARM)

Course groups and languages

The information provided is provisional until November 30. After this date, you will be able to consult the language of each group through this link. To access the information, you will need to enter the course CODE

Type of teaching	Group	Language	Semester	Shift
(TE) Theory	31	Catalan/Spanish	second semester	morning-mixed
(TE) Theory	33	Catalan/Spanish	second semester	morning-mixed
(PAUL) Classroom practices	311	Catalan/Spanish	second semester	morning-mixed
(PLAB) Practical laboratories	311	Catalan/Spanish	second semester	morning-mixed
(PAUL) Classroom practices	312	Catalan/Spanish	second semester	morning-mixed
(PLAB) Practical laboratories	312	Catalan/Spanish	second semester	morning-mixed
(PLAB) Practical laboratories	313	Catalan/Spanish	second semester	morning-mixed
(PLAB) Practical laboratories	314	Catalan/Spanish	second semester	morning-mixed
(PLAB) Practical laboratories	315	Catalan/Spanish	second semester	morning-mixed
(PLAB) Practical laboratories	316	Catalan/Spanish	second semester	morning-mixed
(PLAB) Practical laboratories	317	Catalan/Spanish	second semester	morning-mixed
(PLAB) Practical laboratories	318	Catalan/Spanish	second semester	morning-mixed
(PAUL) Classroom practices	331	Catalan/Spanish	second semester	morning-mixed

(PAUL) Classroom practices	332	Catalan/Spanish	second semester	morning-mixed