COURSE DATA

DATA SUBJECT

Code: 34655
Name: Fundamentals of computers
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
1400 - Degree in Computer Engineering	Escola Tècnica Superior d'Enginyeria	1	Second quarter
1936 - Double Degree Program in Mathematics-Telematics Engineering	Facultat de Ciències Matemàtiques	1	Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1400 - Degree in Computer Engineering	Information technology	BASIC
1936 - Double Degree Program in Mathematics-Telematics Engineering	Primer curso	COMPULSORY

COORDINATION

RUIZ GONZALBO AURELIO

SUMMARY

The subject "Fundamentals on Computers" is a compulsory on first course in the Degree on Computer Engineering. Set to a commitment of 6 ECTS taught in the second semester of the first course.

The aim of the course is to acquaint students with the fundamentals of computers, primarily from its architecture and programming. We introduce the classical model of von Neumann's computer and using machine language assembler.

The first block introduces the language of computers, machine language, and the student ends up dominating the types of instructions and addressing modes, to continue the instruction formats and the repertoire or set of instructions available. Following the definitions in generic form is passed to particularize the study to a particular processor such as ARMv8. Following the program, then it is intended that the pupil knows the VHDL as a language for describing vehicular hardware. Formal language is introduced and consolidated the various styles of architecture.

Then the goal becomes understanding how the basic building blocks of computer components and their role in the development of architecture. From this point the student will be able to design the data path followed and in turn drive the design of wired and microprogrammed control, both as unicycle and multicycle processors, respectively. Following the same line, then is to get to know one of the main components in the structure of a computer, such as the Arithmetic-Logic Unit (ALU). You learn to design small circuits that are able to perform simple operations such as addition and displacement, and integrated modules capable of complex operations such as multiplication. These modules are the building blocks of the ALU and the main objective is that students learn to design and modify a small ALU able to function properly. The software on the ALU will teach the student integer and floating point arithmetics.

Finally it explores the use of simple programmable devices, inherent to working with HDL and CAD tools, allowing the achievement of ultimate goal: that students become familiar with its use to create small sequential systems using tools that automate repetitive processes for a large number of functions.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

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

OTHER REQUIREMENTS

No previous knowledge needed, but this subject is the logic follow-up of Computer Technology, which is taught on the 1st term. Therefore, the students should have studied previously Computer Technology.

COMPETENCES / LEARNING OUTCOMES

1400 - Degree in Computer Engineering

B1 - Ability to solve the mathematical problems that may arise in engineering. Ability to apply knowledge of linear algebra, differential and integral calculus, numerical methods, numerical algorithms, statistics and optimisation.

B3 - Ability to understand and master the basics of discrete mathematics, logic, algorithms and computational complexity and their application for solving problems in engineering.

B5 - Knowledge of the structure, organisation, operation and interconnection of computer systems, programming fundamentals, and their application for solving problems in engineering.

G8 - Knowledge of basic subject areas and technologies that serve as a basis for learning and developing new methods and technologies, and of those which provide versatility to adapt to new situations.

G9 - Ability to solve problems with initiative, decision making, autonomy and creativity. Ability to communicate and transmit the knowledge, skills and abilities of a computer engineer.

DESCRIPTION OF CONTENTS

1. Sequential circuits

State machines (Mealy and Moore): Performance, construction and description.
Design of a complex digital system.

2. Hardware Description Language (VHDL) and programmable devices

Sintactic elements.
Comportamental, estructural and data flow description.
VHDL description of state machines.
Programming technologies
Programmable Logic Devices: CPLDs, FPGAs.

3. Machine Language

Type of instructions
Format of instructions
Addressing Modes
Particular case: ARMv8

4. Data path. Pipeline

Unicycle processor and control
Pipeline processor and control
Pipeline hazards

5. Arithmetic-Logic Unit

Arithmetic with integers
Adders/Substractors
Multiplyers
Divisors
Floating point Arithmetic
Format IEEE-754

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	30,00
Laboratory	20,00
Classroom practices	10,00
Total hours	**60,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	25,00
Independent study and work	10,00
Preparation of lessons	30,00
Preparation for assessment activities	22,00
Resolution of case studies	3,00
Total hours	**90,00**

TEACHING METHODOLOGY

The methodology used in the course is based on the conduct of lectures and problems that will be complemented by the student's independent work. The target ratio for each of these activities is as follows:

• theoretical activity.
Description: The lectures will develop the issues by providing a global and inclusive vision, analyzing in detail the key issues and more complex, encouraging at all times, participation of students.
Workload for students on the total load of matter: 19%

• Practical activities.
Description: Complementing theoretical activities in order to apply the basics and expand the knowledge and experience to be acquired in the course of the work proposed. They include the following types of classroom activities:

- classes of problems and issues in the classroom
- discussion sessions and problem-solving exercises and previously worked by the students.
- Practices in Labs
- tutorials scheduled (individualized or group).
- Making of individual evaluation questionnaires.

Workload for students on the total charge of the matter: 21%

• Individual student work.
Description: Realization (outside the classroom) of monographs, literature search directed, issues and problems as well as the preparation of classes and exams (study). This is done individually and tries to promote self- work.
Workload for students on the total charge of the matter: 45%

• Work in small groups.
Description: Realization, by small groups of students (2-4) of work, issues, problems outside the classroom. This work complements the work and encourages individual ability to integrate into working groups.
Workload for students on the total charge of the matter: 15%

It will be used the platform of e-learning (virtual classroom) of the University of Valencia in support of communication with students. Through it you will have access to course materials used in class as well as solve problems and exercises.

EVALUATION

The course evaluation will be performed in the first call preferably by continuous assessment (C) and the evaluation of laboratory activities (L).

The continuous assessment mark (C) is calculated as the average of 3 continuous assessment tests, done during the course, at the end of each group of subjects: P1, P2 and P3. It will de uses the following expression, which reflects the relative weight of each topic:

C = 0.35 * P1 + 0.5 * P2 + 0.15 * P3

The continuous assessment mark (C) can be improved until 1 point with extra activities (Aext) done during the course, whenever C is greater than or equal to 5, calculating the final continuous assessment mark (Cfin) as:

Cfin = C + Aext

If continuous assessment mark (C) is greater than or equal to 5 the student may not make the official the first call examination, calculating the note of the first call (N1a) as:

N1a = 0.75 * Cfin + 0.25 * L

Where laboratory note (L) is calculated as the arithmetic mean of the laboratory session evaluation (SL) and the laboratory test (ExL):

L = 0.5 * SL + 0.5 * ExL

In the case that the continuous assessment is less than 5, the student should make the official first call examination (Ex1), calculating the note of the first call (N1b) as:

N1b = 0.6 * Ex1 + 0.25 * L + 0.15 * C

If a student who has passed the first call with continuous assessment (C> = 5) wants to improve his or her note (N1a), He or She may take the examination Ex1, calculating the note 1st call with N1b formula. This will involve refusing the mark given by the formula N1a.

The mark of the second call (N2) is calculated in only one way, from the second call exam (Ex2), the lab notes (L) and continuous assessment (C) defined before. If the lab notes (L) is less than 5, the student will have the option to repeat the laboratory test (EXL).

N2 = 0.6 * Ex2 + 0.25 * L + 0.15 * C

Copying or plagiarism of any activity that is part of the evaluation will result in the impossibility of passing the course, and the student will then be subject to the appropriate disciplinary procedures indicated in the ACTION PROTOCOL FOR FRAUDULENT PRACTICES AT THE UNIVERSITY OF VALENCIA (ACGUV 123/2020).

In any case, the evaluation of this subject will be done in compliance with the University Regulations in this regard, approved by the Governing Council on 30th May 2017 (ACGUV 108/2017)

REFERENCES

- Patterson/Hennessy. Computer organization and design. ARM Edition. Ed. Elsevier. 2017
- Fernando Pardo y J. Antonio Boluda VHDL Lenguaje para síntesis y modelado de circuitos. Editorial RA-MA, 1999
- S. Barrachina, M. Castillo, J.M. Claver, J.C. Fernández. Prácticas de introducción a la arquitectura de computadores con el simulador SPIM, Ed. Pearson, 2013

- W. Stallings. Organización y Estructura de Computadores. Diseño para optimizar prestaciones. Ed. Prentice Hall, 2006.

- John Wakerly. Diseño digital. Principios y prácticas 3ª Edición. Editorial Prentice-Hall, 2001.

- S. Brown and Z. Vranesic. Fundamentals of Digital Logic with VHDL Design. 3e. Editorial Mcgraw-Hill Series in Electrical and Computer Engineering), 2005.