VNIVERSITAT DE VALÈNCIA

Course Guide
34654 Computer technology

COURSE DATA

Data Subject	
Code	34654
Name	Computer technology
Cycle	Grade
ECTS Credits	6.0
Academic year	2023 - 2024

Study (s)

Degree	Center	Acad. year	Period
1400 - Degree in Computer Engineering	School of Engineering	1	First term
1936 - PDG Matemàtiques-Informàtica	Faculty of Mathematics	1	First term

Subject-matter

Degree	Subject-matter	Character
1400 - Degree in Computer Engineering	5 - Information technology	Basic Training
1936 - PDG Matemàtiques-Informàtica	1 - Primer curso	Basic Training

Coordination

Name	Department
BOLUDA GRAU, JOSE ANTONIO	240 - Computer Science

SUMMARY

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

This course aims to introduce students to the technological foundations that underpin the design of the components that make computers and develop the skills necessary to perform both the design of these circuits as choosing the most appropriate technologies and solutions in each case.

For this, the course is divided into two main blocks. At first it is intended that the student develops the foundations of circuit theory and learn about the behaviour and construction of electronic and photonic devices focusing on functionality and practicality.

In the second section the student will work the technical design of digital logic circuits, both combinational and sequential focusing on the implementation of these circuits in the construction of the components of computers using both mathematical descriptions and blocks as hardware description languages

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

There are no previous requirements needed.

OUTCOMES

1400 - Degree in Computer 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.
- B2 - Understanding and mastery of basic concepts of fields and waves and electromagnetism, electrical circuit theory, electronic circuits, physical principles of semiconductors and logic families, electronic and photonic devices and their application for solving problems in engineering.
- B3 - Ability to understand and master the basics of discrete mathematics, logic, algorithms and computational complexity and their application for solving problems in 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.

LEARNING OUTCOMES

This course allows for the following learning outcomes:

- Use mathematical expressions to describe the functions of simple combinational and sequential circuits.
- Design simple digital circuits using the fundamental building blocks (gates, FF, registers, counters, PLA).
- Design simple digital circuits using a language of high-level description.
- Understand and explain how negative integers are stored (in sign-magnitude and 2-complement)

and rendering formats of numerical data.
- Convert numerical data from one format to another.
- Work together to make designs and configurations necessary, distributing the workload to deal with complex problems.
- Knowledge of the different materials used in the manufacture of electronic and photonic devices.
- Understand the operation of the components and basic electronic circuits and photonics.
- Analyse and design basic digital electronic circuitry, using different techniques established for it.
- Explain the characteristics of different logic families using the most appropriate in each case.
- Explain the basics of circuit theory to be able to use these notions to the design and analysis of electronic circuits.

To complement the above results, this subject also to acquire the following skills and social skills:

• Capacity for analysis and synthesis
• Ability to argue from rational and logical criteria.
• Ability to communicate properly and organized.
• Ability to personal work.
• Ability to work in groups.

DESCRIPTION OF CONTENTS

1. Circuit theory

Ohm laws.
Kirchhoff laws.
Capacitive and inductive devices.

2. Electronics and Photonics

Semi-conductor materials. Semi-conductor P and N. The diode.
Bipolar Junction Transistors (BJT). Features and basic configurations.
Switching electronics with BJTs. The inverter.
MOSFET Transistors. CMOS configuration. Switching electronics with CMOS.
Photonic devices; LED diodes, phototransistors, optocoupplers, etc.

3. Information representation

Positional Numeric Systems. Binary, octal and hexadecimal numbers.
Conversion in positional Systems.
Addition and substraction of binary numbers. Negative numbers representation.
Alphanumeric representation.

4. Combinational circuits

Boolean algebra: basic theorems and properties.
Representation of logic functions: expresions, schemes, tables.
Logic functions analysis.
Logic functions synthesis.
Introduction to VHDL for describing combinacional circuits.
PALs and PLAs: programmable logic concept.
MSI combinational circuits.

5. Digital parameters and logic families

Static and dynamic parameters. Logic families TTL and CMOS. Tables of features.

6. Sequential circuits

Synchronous flip-flops: Performance, construction and VHDL description.
Registers and counters: Performance, construction and VHDL description.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	30,00	100
Laboratory practices	20,00	100
Classroom practices	10,00	100
Development of group work	5,00	0
Development of individual work	20,00	0
Study and independent work	5,00	0
Readings supplementary material	5,00	0
Preparation of evaluation activities	20,00	0
Preparing lectures	15,00	0
Preparation of practical classes and problem	15,00	0
Resolution of case studies	3,00	0
Resolution of online questionnaires	2,00	0
TOTAL	**150,00**	

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 (CA) and the evaluation of laboratory activities (L).

The continuous assessment mark (CA) 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:

$$AC = 0.3 * P1 + 0.5 * P2 + 0.2 * P3$$

If continuous assessment mark 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:

$$N1a = 0.75 * C + 0.25 * L$$

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 both methodologies and keeping the higher one between N1a or N1b.

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 mark of the laboratory (L) is below 5, the student will have the opportunity of taking the laboratory exam again (EXL). The marks achieved during the laboratory classes (SL) and the continuous assessment (C) are the same and cannot be changed.

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

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

Basic

- Anant Agarwal, Jeffrey Lang. Foundations of Analog and Digital Electronic Circuits. Morgan Kaufmann, 1ª edición, 2005.
  On line: http://proquest.safaribooksonline.com/9780080506814

- John Wakerly. Digital Design. 5th Edition. Editorial Pearson, 2013.
- Alberto Malvino. Principios de Electrónica. Editorial Mcgraw-Hill. 2007.

Additional

- Fernando Pardo y J. Antonio Boluda VHDL Lenguaje para síntesis y modelado de circuitos. 3era Edición. Editorial RA-MA, 2011.
- S. Brown and Z. Vranesic. Fundamentals of Digital Logic with VHDL Design. 3e. Editorial Mcgraw-Hill Series in Electrical and Computer Engineering), 2005.
- M. Morris Mano y Michel Ciletti. Diseño Digital. 5ª Edición. Editorial Pearson, 2013.