Universidad de Alcalá

TEACHING GUIDE

Fundamentals of Computer Technology

Teach out (only exams)

Bachelor's Degree on:
Computer Science
Computer Engineering
Information Systems

Universidad de Alcalá

2020/2021

1st course – 1st semester

Approved by the School Board on June 24, 2020

TEACHING GUIDE

Subject name:	Fundamentals of Computer Technology
Code:	780002
Degrees:	Bachelor's Degree on Computer Science Bachelor's Degree on Computer Engineering Bachelor's Degree on Information Systems
Department and area:	Computer Engineering Department. Computer Architecture and Technology area
Type:	Basic
ECTS credits:	6
Course and term:	1st course, 1st semester
Teaching staff:	Rosa Estriégana Valdehita
Language:	Spanish/English

1. COURSE SUMMARY

The subject Fundamentals of Computer Technology is a six credits course taught in the first year of the Grades on Computer Science, Computer Engineering and Information Systems.

The fundamental goal of the course is to understand the basic level operation of a computer. For this purpose, the processing of binary data (bits) at different levels of abstraction is studied, from logic gates to basic electronic devices, with an introduction to the functional units at architectural level.

Therefore, it implies an essential learning for students regardless of their professional profile, and its contents have a close relationship with many other subjects in the curriculum.

Finally, it is important to note that the technology used in manufacturing today's computers is subject to continuous development and involves intensive research throughout the world, particularly by large companies that build microprocessors. This course also gives an overview of possible future technologies (optical computing, quantum computing, etc.)

2. COMPETENCES

Generic Competences:

CG1.- To get a broad and open perspective about companies and the real world in general.

CG2.- To possess strong analytical and critical thinking ability.

CG3.- To possess attitudes consistent with ethical principles on fundamental rights, equality of men and women, universal accessibility and values of a culture of democratic peace.

CG4.- To achieve the ability to design and implement solutions based on technologies that improve organizations performance.

CG5.- To get interpersonal communication and teamwork skills to work on projects and working groups

CG6.- To know the need for a commitment to ethical values and recognition of diversity, multiculturalism and equal opportunities regardless of religion, race and gender.

Learning Outcomes:

RA1.- To know the physical foundations of a computer system.

RA2.- To know the underlying mathematical elements in the dynamics of a computer system

RA3.- To work with binary numbers, other systems of representation and their arithmetics. To perform logic functions with networks of logic gates and to simplify associated circuits. CE-DIG1, CE-DIG2, CE-AR2

RA4.- To analyze and design combinational logic networks. To analyze the behavior of synchronous and asynchronous machines CE-DIG4, CE-DIG5.

RA5.- To apply the principles of design of digital systems CE-DIG6

3. CONTENTS

Content blocks	Hours and credits
1. Introduction • Levels of abstraction in the study of computers and relation with other subjects in the curriculum. • Historical evolution of computers. • Von Neumann Architecture and instruction execution. • Programming languages. • Performance.	• 3 theory hours • 2 laboratory hours
2. Bases and Numbering Systems • Pure binary, sign magnitude, 1's complement and 2's complement. • Hexadecimal • Arithmetics in different numbering systems.	• 5 theory hours • 2 laboratory hours
3. Combinational Systems • Introduction to Digital Systems. • Logical operations and logic gates. • Logic functions, truth tables and simplification: Karnaugh maps. • Analysis and synthesis of combinational circuits. • Basic Combinational Circuits: adders, decoders, multiplexers.	• 9 theory hours • 10 laboratory hours
4. Sequential Systems • Latches and flip-flop. Definition and types • Registers. • Counters. • Sequential systems design.	• 9 theory hours • 10 laboratory hours
5. Memory System • Memory system hierarchy • Memory operation. Address, control and data buses. • Types and memory technologies.	• 4 theory hours • 4 laboratory hours

Schedule

It will be detailed in the subject website at the beginning of each course.

4. TEACHING LEARNING METHODOLOGIES.-FORMATIVE ACTIVITIES

Formative activities are developed in one subject with 6 ECTS credits. In the teaching-learning process, the following training activities will be used:

- Theoretical classes.
- Practical classes: problem solving.
- Practical classes: laboratory.
- Tutorials: individual and/or group.

The following training activities may be used as well:

- Individual or group assignments: realization, presentation and discussion
- Attendance to conferences, meetings and scientific discussions related to the subject.

To achieve the specified competencies, activities are distributed as follows:

- 3 theoretical credits based on lectures in which students will acquire all the required knowledge about the skills.
- 3 practical credits (of which, one third may be acquired in person and two thirds by the individual student work), by solving problems and laboratory activities in which students will complete their training to achieve the skills.

4.1. Credit Distribution

Number of attendance hours:	28 hours in large group 28 hours in small group (problem solving and lab) 2 hours' exam
Number of hours of student's independent work:	92 hours including assimilation of theoretical concepts, problem solving, assignment, lab preparation and tutorship
Total	150 hours

4.2. Methodological strategies, teaching materials and resources

The teaching strategy is based on a model of reflective learning of concepts and their application to solve exercises.

In large groups the lecture will be combined with problem solving by the teacher and by the students, with exercises and both individual and group activities.

For small groups and lab work, a participatory and active student strategy Is proposed to promote teamwork and peer learning, enriching the theory concepts and helping to verify their evolution in the teaching-learning process.

In the lab. the students will perform practices to gain skills in assembling combinational, sequential and memory systems. For that purpose, they will use specific equipment as power sources and multimeters.

Information Communication Technologies may be used to support training activities (Internet and e-mail forums, e-learning platforms, etc.)

5. EVALUATION: Procedures, evaluation criteria and qualification

Evaluation procedure.
The annual evaluation process consists of two sessions: an ordinary call and an extraordinary call.

Both the ordinary and extraordinary calls will consist of two parts: theory and laboratory. The theory will represent 60% of the grade for the course and the laboratory will represent 40% of the grade.

Evaluation Criteria

The assessment of the acquisition of competencies will consider the following criteria:

CE1: Mastering of contents and basic concepts.

CE2: Application of contents in solving problems and lab practices.

CE3: Interest and motivation in the tasks and practices.

The evaluation of skills acquired in the labs will consider the following criteria:

CE4: To know how the different functional units of a computer interact with each other

CE5: To know how to use the basic lab instrumentation (multimeter, power supply, etc.) and correctly make the connections among the various components and integrated circuits.

Evaluation tools

1. The final evaluation call, both ordinary and extraordinary, will be a Final Exam (PEF) consisting on solving practical and theoretical problems.
2. In the extraordinary call there will be a Final Lab Exam (PEFLAB) that could consist in theoretical and practical exercises, and in designing and implementing combinational/sequential systems and explaining them

Qualification criteria
The final grade for the course will consist of:

- 60% of the theory grade
- 40% of the laboratory grade

Ordinary and extraordinary calls

Competence	Learning Outcome	Evaluation criteria	Evaluation tool	Weight in grades
CG1 – CG6	RA1-RA5	CE1-CE3	PEF	60%
		CE4, CE5	PEFLAB	40%

6. BIBLIOGRAPHY

Basic bibliography

- Digital Fundamentals, 10th edition 2008
  Thomas Floyd. Prentice-Hall.

Supplementary Bibliography

- Logic and Computer Design Fundamentals.
  M. Morris Mano, C. R. Kime, Pearson/Prentice-Hall 2004
- Digital Design.
  M. Morris Mano, Pearson/Prentice-Hall 2003

Disclosure Note

The University of Alcalá guarantees to its students that, if due to health requirements the competent authorities do not allow the total or partial attendance of the teaching activities, the teaching plans will achieve their objectives through a teaching-learning and evaluation methodology in online format, which will return to the face-to-face mode as soon as these impediments cease.