Universidad de Alcalá

TEACHING GUIDE

Fundamentals of Computer Technology

Degree in
Computer Engineering (GIC)
Computer Science Engineering (GII)
Computer Science Engineering and Business Management and Administration (GII-ADE)

Universidad de Alcalá

Academic Year 2025/2026

1st Year - 1st Semester (GIC+GII)

2º Curso - 1er Cuatrimestre (GII-ADE)

Approved by the EPS School Board on June 16th, 2025

TEACHING GUIDE

Course Name:	**Fundamentals of Computer Technology**
Code:	**780002 (GIC+GII+GII-ADE)**
Degree in:	**Computer Engineering (GIC)** **Computer Science Engineering (GII)** **Computer Science Engineering and Business Management and Administration (GII-ADE)**
Department and area:	**Automática** **Computer Architecture and Technology**
Type:	**Basic (GIC+GII)** **Básica (GII-ADE)**
ECTS Credits:	**6.0**
Year and semester:	**1st Year - 1st Semester (GIC+GII)** **2º Curso - 1er Cuatrimestre (GII-ADE)**
Teachers:	Por definir
Tutoring schedule:	Consultar al comienzo de la asignatura
Language:	English

1. COURSE SUMMARY

The subject Fundamentals of Computer Technology is a six credits course taught in the first year of the Bachelor's Degrees 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. SKILLS

Basic, Generic and Cross Curricular Skills.

This course contributes to acquire the following basic, generic and cross curricular skills:

en_CG1 - Ability to conceive, write, organize, plan, develop and sign projects in the field of computer engineering that are intended, in accordance with the knowledge acquired as established in section 5, annex 2, of resolution BOE-A -2009-12977, the conception, development or exploitation of computer systems, services and applications.

en_CG4 - Ability to define, evaluate and select hardware and software platforms for the development and execution of computer systems, services and applications, in accordance with the knowledge acquired as set out in section 5, annex 2, of resolution BOE-A-2009 -12977.

en_CG8 - Knowledge of the basic subjects and technologies, which enable them to learn and develop new methods and technologies, as well as those that provide them with great versatility to adapt to new situations.

en_CG9 - Ability to solve problems with initiative, decision making, autonomy and creativity. Ability to know how to communicate and transmit the knowledge, skills and abilities of the profession of Computer Engineering Engineer.

en_CG10 - Knowledge to perform measurements, calculations, assessments, appraisals, appraisals, studies, reports, task planning and other similar computer work, in accordance with the knowledge acquired as set out in section 5, annex 2, of BOE resolution -A-2009-12977.

en_CB1 - That students have demonstrated to possess and understand knowledge in an area of study that is based on general secondary education, and is usually found at a level that, although supported by advanced textbooks, also includes some aspects that involve knowledge from the forefront of their field of study.

en_CB2 - That the students know how to apply their knowledge to their work or vocation in a professional manner and possess the competencies that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study.

en_CB3 - That students have the ability to gather and interpret relevant data (usually within their area of study) to make judgments that include a reflection on relevant social, scientific or ethical

issues.

en_CB4 - That students can transmit information, ideas, problems and solutions to both a specialized and non-specialized public.

en_CB5 - That the students have developed those learning skills necessary to undertake further studies with a high degree of autonomy.

en_TRU1 - Capacity of analysis and synthesis.

en_TRU2 - Oral and written competencies.

en_TRU3 - Ability to manage information.

en_TRU4 - Autonomous learning skills.

en_TRU5 - Team work.

Specific Skills

This course contributes to acquire the following specific skills:

en_CI9 - Ability to know, understand and evaluate the structure and architecture of computers, as well as the basic components that make them up.

en_CIB2 - Understanding and mastery of the basic concepts of fields and waves and electromagnetism, theory of electrical circuits, electronic circuits, physical principle of semiconductors and logical families, electronic and photonic devices, and their application for solving engineering problems.

Learning **Outcomes**

After succeeding in this subject the students will be able to:

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 arithmetic. To perform logic functions with networks of logic gates and to simplify associated circuits.

RA4. To analyse and design combinational logic networks. To analyse the behavior of synchronous and asynchronous machines.

RA5. To apply digital system design principles.

3. CONTENTS

Bloques de contenido	Total de clases, créditos u horas
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.	• 8 theory hours • 10 laboratory hours
4. Sequential Systems • Latches and flip-flop. Definition and types • Registers. • Counters. • Sequential systems design.	• 8 theory hours • 10 laboratory hours
4. Memory System • Memory system hierarchy • Memory operation. Address, control and data buses. • Types and memory technologies	• 4 theory hours • 4 laboratory hours

4. TEACHING - LEARNING METHODOLOGIES. FORMATIVE ACTIVITIES.

4.1. Credits Distribution

Number of on-site hours:	60 hours (56 hours on-site + 4 exams hours)
Number of hours of student work:	90
Total hours	150

4.2. Methodological strategies, teaching materials and resources

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: realisation, 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.

5. ASSESSMENT: procedures, evaluation and grading criteria

Preferably, students will be offered a continuous assessment model that has characteristics of formative assessment in a way that serves as feedback in the teaching-learning process.

5.1. PROCEDURES

The evaluation must be inspired by the criteria of continuous evaluation (Learning Assesment Guidelines, LAG, art 3). However, in compliance with the regulations of the University of Alcalá, an alternative process of final evaluation is made available to the student in accordance with the Learning Assesment Guidelines as indicated in Article 10, students will have a period of fifteen days from the start of the course to request in writing to the Director of the Polytechnic School their intention to take the non-continuous evaluation model adducing the reasons that they deem convenient. The evaluation of the learning process of all students who do not apply for it or are denied it will be done, by default, according to the continuous assessment model. The student has two calls to pass the subject, one

ordinary and one extraordinary.

Preferably students will be offered a system of continuous evaluation. For this purpose, the following procedures, evaluation criteria, evaluation tools and qualification criteria are established:

Ordinary Call
The ordinary call consists either of continuous Assessment or final evaluation.

Continous Assessment:

It will consist of completion and delivery of learning and assessment activities distributed throughout the semester.

The theory grade will be set based on the performance in two exams during the course and an assignment (written and presented as a seminar to the rest of class).

The lab grade will be set based on the completion, submission and defence of the proposed practices. The realisation in the lab of such practices is compulsory and therefore there is no final lab exam. The only way to pass the lab (and therefore the subject) is finishing properly the practices on schedule in the lab.

Students who undergo continuous evaluation and failed will not be qualified for the final evaluation of the ordinary examination.

Assessment through final exam:

Students who obtain permission from the Director of the Centre to qualify for the final evaluation will be evaluated by a single theory exam consisting of theoretical questions and exercises similar to those carried out during the course and will account for the total theory grade.

Following article 6.4 of the Learning Assessment Regulations, It is essential to overcome mandatory practices carried out during the course to pass the course. Therefore, the students who choose the final evaluation should contact the coordinators of the subject during the first two weeks of the course to set evaluating sessions during the first quarter.

Extraordinary Call

Those students who have not passed the ordinary evaluation (either continuous or final) may attend to an extraordinary exam.

The extraordinary call will consist of two parts: theory and laboratory and such as the ordinary call, the theory will represent 60% of the grade for the course and the laboratory will represent 40% of the grade.

Students who have not passed one of the parts in the ordinary call (either theory or laboratory), can attend only that part in the extraordinary call.
Following article 6.4 of the Learning Assessment Regulations, it is essential to overcome mandatory practices carried out during the course to pass the course. Therefore, the students who have not passed the practical part of the subject should contact the coordinators of the subject during the first two weeks of the second quarter to set evaluating sessions.

5.2. EVALUATION

EVALUATION CRITERIA

The assessment criteria measure the level in which the competences have been acquired by the student. For that purpose, the following are defined:

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.

GRADING TOOLS

1. Lab practices (PL): Design and realisation of various combinational and sequential circuits.
2. Assignment (TA): The teacher may propose the realization of an assignment on a topic related to the subject and/or participation in various activities carried out inside and/or outside the classroom.
3. Evaluation tests (PE): Consisting of analysing and solving exercises and theoretical and practical problems.
4. The final evaluation call, both ordinary and extraordinary, will be a Final Exam (PEF) consisting on solving practical and theoretical problems.
5. 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

GRADING CRITERIA

The final grade for the course will consist of:
• 60% of the theory grade
• 40% of the laboratory grade

In order to pass the course in any of the evaluation procedures is an essential requirement to pass both theoretical part and laboratory part.

The relationship between the competences, learning outcomes, criteria and evaluation instruments is as follows

Ordinary call, Continuous Evaluation

Competence	Learning Outcome	Evaluation criteria	Evaluation tool	Weigh in grade
CB1, CB2, CB3, CB4, CI9, CIB2, TRU1-TRU5, CG4, CG8, CG9, CG10	RA1, RA2 RA3, RA4	CE1, CE2, CE3	EP, PEI1	30%
CB1, CB2, CB3, CB4, CB5, CI9, CIB2, TRU1-TRU5, CG8, CG9,CG10	RA1, RA2, RA3, RA4, RA5	CE1, CE2, CE3	EP, PEI2	30%
CB1, CB2, CB3, CB4, CB5, CI9, CIB2, TRU3, TRU4, TRU5, CG1, CG4, CG8, CG9,CG10	RA1, RA2, RA3, RA4, RA5	CE1, CE2, CE3, CE4, CE5	EL	40%

Ordinary call, Final Evaluation

Competence	Learning Outcome	Evaluation criteria	Evaluation tool	Weigh in grade
CB1, CB2, CB3, CB4, CB5, CI9, CIB2, TRU1-TRU5, CG4, CG8, CG9,CG10	RA1, RA2, RA3, RA4, RA5	CE1, CE2, CE3	PEF	60%
CB1, CB2, CB3, CB4, CB5, CI9, CIB2, TRU3, TRU4, TRU5, CG1, CG4, CG8, CG9,CG10	RA1, RA2, RA3, RA4, RA5	CE1, CE2, CE3, CE4, CE5	PL, EL	40%

Extraordinary call

Competence	Learning Outcome	Evaluation criteria	Evaluation tool	Weigh in grade
CB1, CB2, CB3, CB4, CB5, CI9, CIB2, TRU1-TRU5, CG4, CG8, CG9,CG10	RA1, RA2, RA3, RA4, RA5	CE1, CE2, CE3	PEF	60%
CB1, CB2, CB3, CB4, CB5, CI9, CIB2, TRU3, TRU4, TRU5, CG1, CG4, CG8, CG9,CG10	RA1, RA2, RA3, RA4, RA5	CE1, CE2, CE3, CE4, CE5	PL, EL	40%

The teaching-learning methodology and the assessment process will be adapted as needed, in accordance with the guidelines of the Diversity Support Unit, to implement curricular adaptations for students with specific needs.

6. BIBLIOGRAPHY

6.1. Basic Bibliography

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

6.2. Additional Bibliography

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

Disclosure Note

During the evaluation tests, the guidelines set out in the Regulations establishing the Rules of Coexistence of the University of Alcalá must be followed, as well as the possible implications of the irregularities committed during said tests, including the consequences for committing academic fraud according to the Regulation of Disciplinary Regime of the Students of the University of Alcalá.