1. OVERVIEW

Subject area	Fundamentals of Computer Science
Degree	Bachelor's Degree in Computer Engineering
School/Faculty	School of Architecture, Engineering and Design
Year	First
ECTS	6 ECTS
Type	Compulsory
Language(s)	Spanish
Delivery mode	On campus / Online
Semester	First semester
Year	2022 / 2023
Coordinating professor	Sergio Bemposta Rosende
Teacher	Sergio Bemposta Rosende

2. INTRODUCTION

Fundamentals of Computer Science will enable the student to learn how a computer works from the inside, the parts it contains, as well as how the computer communicates at a low level.

The basic knowledge of how computers work at a low level, the components that form them, as well as the way in which information is transmitted will be established, allowing the student to interact with them at a low level and to understand how communication works at more abstract levels.

Largely due to the rapid evolution of technologies in the field of computer science, it is quite common for new professionals to interact with computers and lose sight of what is actually happening in the computer. This subject area fills this gap, giving students an in-depth view of the inner workings of a computer, enabling them to interact with it in an optimal way, as well as providing them with the necessary knowledge to participate in the innovation of platforms, architectures, components and, in general, the physical part of infrastructures.

3. SKILLS AND LEARNING OUTCOMES

Basic skills (CB, by the acronym in Spanish):

- CB1: Students have demonstrated knowledge and understanding of a study area originating from general secondary school education, and are usually at the level where, with the support of more advanced textbooks, they may also demonstrate awareness of the latest developments in their field of study.
- CB2: Students can apply their knowledge to their work or vocation in a professional manner and possess the skills which are usually evident through the forming and defending of opinions and resolving problems within their study area.
- CB3: Students have the ability to gather and interpret relevant data (usually within their study area) to form opinions which include reflecting on relevant social, scientific or ethical matters.
- CB5: Students have developed the learning skills necessary to undertake further study in a much more independent manner.

Transversal skills (CT, by the acronym in Spanish):

- CT4: Ability to analyse and synthesise: be able to break down complex problems into manageable blocks; evaluate other options and perspectives to find the ideal solution.
- Synthesising to reduce the complexity and better understand the situation and/or solve problems.
- CT5: Ability to put knowledge into practice, using the skills acquired through the study of mock situations based faithfully on real life issues in the relevant profession.
- CT12: Critical thinking: Ability to analyse an idea, occurrence or situation from different perspectives and adopt a personal viewpoint based on scientific rigour and objective reasoning, rather than intuition.
- CT16: Decision-making: Ability to choose between different options or methods to effectively solve varied situations or problems.

Specific skills (CE, by the acronym in Spanish):

- CE3: Ability to understand and master the basic concepts of discrete mathematics, logic, algorithmics and computational complexity, and their application to solve engineering problems.
- CE5: Knowledge of the structure, organisation, operation and interconnection of computer systems, the fundamentals of their programming, and how they are used to solve engineering problems.

Learning outcomes (RA, by the acronym in Spanish):

- RA1: Understand data representation on a computer.
- RA2: Solve simple digital combinational systems.
- RA3: Implement a digital combinational system in the laboratory.
- RA4: Understand the solutions to the exercises with group presentations where the student will demonstrate their ability to communicate orally and in writing and apply the contents of the course to make critical judgements.

The following table shows how the skills developed in the subject area match up with the intended learning outcomes:

Skills	Learning outcomes
CB1, CB5, CE3	RA1
CB1, CT4, CT3, CE3, CE5	RA2
CB1, CB2, CT5, CT12	RA3
CB1, CB2, CB5, CT6	RA4

4. CONTENTS

Unit 1. Introduction to Computer Science

- Areas of computer science
- History of computer science
- Abstraction levels in computer science

The aim of this unit is to place the student in a computer science career and make them understand the very recent history of computer science and the events that have led to its development.

Unit 2: Data representation

- Binary
- Representation of the integers
- Floating Point Representation
- Data representation

The aim of this unit is to learn binary language and understand how data is stored in a computer.

Unit 3: Basic Electronic Circuits

- Logic gates
- Boolean Algebra and Logical Functions
- Simplifying functions
- Combinational circuits

The aim of this unit is to understand how any electronic element or component of a computer is built and to make the association of binary and electrical voltage.

Unit 4. Introduction to computers

- Von Neumann architecture
- Memory
- ALU
- Input / Output

The aim of this unit is to look at each of the components that make up a classic computer and their interconnection. The unit also aims for students to understand the functioning of the whole computer as a unit.

Unit 5: Software

- Programming languages
- Assembly and machine code
- Compiled languages
- Interpreted languages and other languages

The aim of this unit is to understand how software interacts with the computer and what it contributes to the architecture of a computer.

5. TEACHING/LEARNING METHODS

The types of teaching/learning methods are as follows:

- MD2. Lectures, subjects of study and seminars. The “lectures” taught in the on-campus delivery mode are called subjects of study and seminars in the online delivery mode, and are conducted through readings on the topic, technical notes and webinars (which are recorded for students to access).
- MD3. Laboratory work.

- MD4. a) Group research and/or b) group problem-solving. This learning method will be used for the development of both declarative and procedural knowledge. In method type a), a different topic will be assigned to each group to be investigated. Later, new groups will be formed with students who have all studied a different topic, and these new groups will be proposed comprehension and problem-solving activities. In method type b), a series of questions and short problem activities will be proposed to be solved in groups.
- MD5. Designs, understood as practical proposals for solving specific problems (unlike the study of practical cases, it is not a question of delving deeper into the analysis and the real problems. Instead, it is based on this knowledge, and the aim is to provide new solutions in accordance with engineering standards). These learning methods will be used for the development of procedural knowledge. They will be used in all delivery modes and help to develop creative potential and technical skills in the field of engineering.

6. LEARNING ACTIVITIES

The types of learning activities, plus the amount of time spent on each activity, are as follows:

On campus:

Learning activity (AF, by the acronym in Spanish)	Number of hours
AF1: On-campus/online lectures, reading topics and complementary materials, implementation of activities carried out independently and collectively.	50 h
AF2: Work carried out in the classroom independently and in groups Case studies, problem solving, project development, simulation	25 h
AF3: Independent working	50h
AF4: Tutorials, academic monitoring and assessment	25 h
TOTAL	**150 h**

Online:

Learning activity (AF, by the acronym in Spanish)	Number of hours
AF6: Independent reading on complementary topics and materials and implementation of activities carried out independently. Subsequently, asynchronous group discussion on the Campus Virtual forum, and online seminars with the synchronous e-learning tools on the Campus Virtual.	50 h
AF7: Work carried out on the Campus Virtual independently and in groups. Case studies, problem solving, project development, simulation	25 h
AF3: Independent working	50 h
AF8: Tutorials, academic monitoring and assessment through the Campus Virtual.	25 h
TOTAL	**150 h**

7. ASSESSMENT

The assessment systems, plus their weighting in the final grade for the subject area, are as follows:

On campus:

Assessment system	Weighting
SE1: Objective tests: in-class assessable tasks carried out individually.	40%

AS2, AS3, AS6: Various tasks carried out inside and outside the classroom: work, exercises, practice and mini-projects.	50%
AS2, AS3, AS4, AS6: Skill-based aspects of participation in tasks carried out inside and outside of the classroom.	10%

Online:

Assessment system	Weighting
SE8: 2 Objective tests: in-class assessable tasks carried out individually.	60%
AS9, AS10, AS12: Various tasks carried out outside the classroom: work, exercises, practice and mini-projects. Deliverables carried out individually.	20%
AS9, AS10, AS12: Various tasks carried out outside the classroom: work, exercises, practice and mini-projects. Deliverables worked on in groups	15%
AS9, AS10, AS11, AS12. Skill-based aspects of participation in tasks carried out inside and outside of the classroom.	5%

On the Campus Virtual, when you open the subject area, you will find all the details of your assessable tasks and the deadlines and assessment procedures for each task.

7.1. Ordinary exam period

To pass the subject area in the ordinary exam period, you will need a final grade of at least 5.0 out of 10.0 (weighted average) for the subject area. Additionally, you will need:

A grade of at least 5.0 out of 10.0 in all individual, group and laboratory tasks separately.

A grade of at least 5.0 out of 10.0 in all knowledge, written or oral tests.

Laboratory work must be delivered on the day of the activity, at the end of class. It cannot be carried out at any other time.

The grade in the ordinary exam period will appear as NP (No grade reported) if the student fails to submit any assessable task which counts towards the weighted average.

Note on the use of a calculator: The use of calculators that allow programming, have memory or convert to binary is prohibited in the assessment activities.

7.2. Extraordinary exam period (resits)

In the extraordinary exam period, you must deliver the activities indicated by the professor, which will be compulsory for all activities where 5 out of 10 has not been achieved individually.

In addition, the following restrictions will apply:

In the extraordinary exam period, there are no group activities, they are all to be carried out individually. Therefore, each member of the original group must deliver the activity individually.

If you fail the in-person test, you must retake it under the same conditions as in the ordinary exam period.

If you fail the laboratory activity, you will have the same time to complete it as in the ordinary exam period and you will have the same material available to you. This activity must be completed in the laboratory and in person.

In the event that you pass the objective tests and you only have individual or group tasks to carry out in the extraordinary exam period, the professor will reserve the right to hold a face-to-face or online confrontation to defend any exercise that the professor considers appropriate to demonstrate the knowledge acquired.

Note on the use of a calculator: The use of calculators that allow programming, have memory or convert to binary is prohibited in the assessment activities.

8. TIMELINE

The timeline with submission dates for the assessable tasks in this subject area will be indicated in this section:

Assessable tasks	Date
Binary number system	Week 2
Floating point binary number system	Week 3
Activity on logic gates	Week 5
Simple combination circuits	Week 7
Laboratory: Logic gates	Week 8
Complex combination circuits	Week 10
Memory and Cache Memory	Week 12
ALU	Week 14
Top500.org	Week 15
Assessment	Week 16

The timeline may be subject to change for logistical reasons related to the activities. Students will be informed of any changes in due time and course.

9. BIBLIOGRAPHY

The reference material for the subject area is as follows:

Stallings, W. (2006). Organización y arquitectura de computadores. Madrid: Prentice Hall.

Patterson, Hennessy (1995). Organización y diseño de computadores. Madrid: Mc. Graw Hill.

Cerrada Somolinos, José Antonio (2001). Fundamentos de estructura y tecnología de

The recommended bibliography is indicated below:

Angulo, J.M., García, J., Angulo, I, (2003). Fundamentos y estructura de computadores. Madrid: Thomson.

Sánchez Pérez, Omar (2003). Fundamentos para el diseño de computadores de ocho Bits. Servicio de Publicaciones, Universidad de Huelva.

Karnaugh maps. Página explicativa sobre los mapas de Karnaugh.

Available online

Consult

<http://www.electronicsteacher.com/digital/karnaugh-mapping/karnaugh-maps.php>. [Septiembre-2011]

10. DIVERSITY AWARENESS UNIT

Students with special educational needs:

To ensure equal opportunities, curricular adaptations or adjustments for students with special educational needs will be outlined by the Diversity Awareness Unit (UAD, Spanish acronym).

As an essential requirement, students with special educational needs must obtain a report about the curricular adaptations/adjustments from the Diversity Awareness Unit by contacting unidad.diversidad@universidadeuropea.es at the beginning of each semester.

11. STUDENT SATISFACTION SURVEYS

Your opinion matters!

Universidad Europea encourages you to complete our satisfaction surveys to identify strengths and areas for improvement for staff, degrees and the learning process.

These surveys will be available in the survey area of your campus virtual or by email.

Your opinion is essential to improve the quality of the degree.

Many thanks for taking part.