Universidad
de Alcalá

TEACHING GUIDE

Computer Structure and Organization

Degree in
Computer Engineering (GIC)
Computer Science Engineering (GII)

Universidad de Alcalá

Academic Year 2021/2022

1st Year - 2nd Semester (GIC+GII)

TEACHING GUIDE

Course Name:	**Computer Structure and Organization**
Code:	**780010 (GIC+GII)**
Degree in:	**Computer Engineering (GIC)** **Computer Science Engineering (GII)**
Department and area:	**Automática** **Computer Architecture and Technology**
Type:	**Basic (GIC+GII)**
ECTS Credits:	**6.0**
Year and semester:	**1st Year - 2nd Semester (GIC+GII)**
Teachers:	Antonio J. de Vicente Juana Mª. López
Tutoring schedule:	Consultar al comienzo de la asignatura
Language:	English

1. COURSE SUMMARY

Computers Structure and Organization is a second year, first semester, mandatory and 6 ECTS subject.

The main aim of this subject is getting the knowledge about the main blocks and their interrelationships to compound Von Neumann architecture. Different blocks design will be presented in order to assess overall efficiency. Moreover, several assembly languages will be used in laboratory classes.

This subject provides essential knowledge for oriented programming students as well as system managers. Subject contents are based on previous subjects as Computer Technology Fundamentals and will be necessary for further subjects of this study plan.

2. SKILLS

Basic, Generic and Cross Curricular Skills.

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

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_CG6 - Ability to conceive and develop centralized or distributed computer systems or architectures integrating hardware, software and networks in accordance with the knowledge acquired as set out in section 5, annex 2, of resolution BOEA-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_CG11 - Ability to analyze and assess the social and environmental impact of technical solutions, including the ethical and professional responsibility of the activity of the Technical Computer Engineer.

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_CIB5 - Knowledge of the structure, organization, operation and interconnection of computer systems, the fundamentals of their programming, and their application for solving engineering problems.

Learning Outcomes

LO1. To describe Interrelationship between Von Neumann Architecture Blocks.

LO2. Understand how different data path design options, instruction set, control unit, memory, and input/output systems affect final performancel.

LO3. To know the essential characteristics of the Von Neumann architecture and its associated programming model, differentiating the Von Neumann model from other computation models.

LO4. To applymicroprogrammingfundamentals.

LO5.To know cachememorysystems.

LO6.Know the basic methods of synchronization in incoming/outgoing transfers

3. CONTENTS

Theoretical Block Contents	Total hours
Block 1: Data path • Data path and clock frequency • Adder • Speeding up the add operation • Multiply and divide operation	4 hours.
Block 2: Instruction set • Operation and instruction types • Addressing modes • Instructions coding and use frequency. • Compiling process and binary compatibility	4 hours.
Block 3: The Control Unit • Clock frequency and instruction decoding • Elemental operations • Execution Instruction Chronogram • Microprogramming	6 hours.
Block 4: Memory hierarchy • Memory Hierarchy Concept • Cache memory • Cache memory performance	4 hours.
Block 5: Input / Output system • Synchronization • Massive storage Buses	4 hours.

Practice Block Contents	Total hours
Block 1: Assembly language fundamentals • i8086 structure. Assembly program structure. • Instruction types. Transference instructions. • Arithmetical instructions. How to build an executable program. • Using Code View debugger program .	2 hours.
Block 2. How to display data on the screen. The ROM-BIOS • Flag register. • More transference instructions. • Control instructions. • More arithmetical instructions. • Interrupts and types. MS-DOS services. ROM-BIOS services.	6 hours.
Block 3.Memory segmentation and addressing modes • Memory segmentation. • Addressing modes. • Relative addressing mode. • Shift instructions. Logical instructions. • String memory accesses by using relative to base and relative to index addressing modes.	6 hours.
Block 4. The stack, procedures and macros • The stack. • Bit instructions. • Procedure definition. NEAR and FAR procedures. • Passing parameters to a procedure. • Structures and parameters. • Macros and procedures.	6 hours.
Block 5. Instruction format. Directives, string instruction and how to build executable files from several object files. • Instruction formats. • MASM directives. • String instructions. • Several object files assembling and linking.	8 hours.

Students will have one or two Teams Activities sessions for solving problems and doubts in both, theory and practices.

4. TEACHING - LEARNING METHODOLOGIES. FORMATIVE ACTIVITIES.

4.1. Credits Distribution

Number of on-site hours:	58 hours (56 hours on-site +2 exams hours)
Number of hours of student work:	92
Total hours	150

4.2. Methodological strategies, teaching materials and resources

This is a 6 ECTS subject. Formative activities for this learning process will be the following:

- Lectures
- Solving problem sessions
- Laboratory sessions
- Tutorial sessions. Both, individual and group ones

Moreover, following formative activities can be used:

- Individual or group homework.
  Attending to related to the subject conferences.
- To guarantee the acquisition of competences by the student, the subject activities are distributed as:
  3 theoretical ECTS, lectures and discussing activities.
  3 practical ECTS, problem solving and laboratory activities

Communication and Information activities may be used as formative activities support.

Lectures	• Lectures • Practical problem solving • Partial exams
Homework	• Individual study • Problem solving • Activity participation
Tutorial sessions	• Tutorial sessions may be grouped or individual ones. Students ask to the teacher about related to this subject doubt during these sessions.

Students can download subject documentation from the subject Website

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, a system of continuous evaluation will be offered to students. Such continuous evaluation system has characteristics of formative assessment, in order to serve as a feedback in the teaching-learning process of students. For this purpose, the following are set:

Evaluation Procedures

Ordinary exam: Evaluation in the ordinary exam should be based on continuous assessment criteria (Regulatory Standards of teaching and learning processes, NRPEA , Article 3) , consistent with the acquisition of the specified competencies in the subject.
a. **Continuous Assessment:** students must pass laboratory practices and two practices exams. Homework must be passed too. A global exam must be passed too. Evaluation of practices and homework deliveries will take place throughout the semester.
b. **Final assessment:** consist in doing and passing a final exam.

2. Extraordinary exam: two different situations arise:
a. Students with passed homework and practices. Student can choose if previous is kept. The rest of the evaluation will be based on a final exam
b. The student has mark or choose not to take it into account. The evaluation would consist of a full final exam.

Students need a special permission of the Direction Staff if they want to be qualified for the final evaluation process. The student must apply to the Dean of the School in the first two weeks of teaching. Students should explain the reasons that didn't allow them to follow the continuous assessment system in such form. Dean will communicate the decision within a maximum of 15 days. The request will be accepted If no reply was received.

5.2. EVALUATION

Evaluation criteria should address the acquisition of skills by students. Next ones are defined:

- **EC1**. Student can infer how arithmetic operations, rounding techniques are performed
- **EC2**. Student is able to program different instruction sets, as well as design new ones.
- **EC3**. Student has enough knowledge to differentiate among diverse computational models
- **EC4**. Student has enough knowledge to design a control memory with different approaches
- **EC5**. Student can design a memory system hierarchy from a performance requirement document
- **EC6**. Student has knowledge about I/O systems, buses and different synchronization methods

Assessment Tools.

This section specifies the evaluation tools to be applied to each of the evaluation criteria.

- Continuous Assessment Test (CAT): consist of solving problem activities, and short question test.
- Homework Deliverables (HD): homework consists of readings about current microprocessors. It can be optional.
- Practices Deliverables (PD): practices are related to assembly language programming at laboratory sessions. Evaluation will include practical solving activities at laboratory because of the practical characteristic of this subject.
- Following activities (FA): Following activities are some sort exercise deliveries or a short test exam that assesses comprehension of previous classes.

- Global Assessment Test (GAT): Consists of problem-solving tasks, short question tests and essay question activities about characteristics and performance of computer system.

Flinal Marks Criteria

This section summarizes the evaluation criteria for passing the subject.

Ordinary exam - continuous assessment

Ordinary exam - continuous assessment. The relationship among criteria, instruments and marks will be as follows

Competences	Learning Outcomes	Evaluation Criteria	Assessment Tools	Weight in Mark
en_CG4, en_CG6, en_CG9, en_CG11, en_CIB5	LO1-LO4	EC1-EC3	CAT	20%
en_CG4, en_CG6, en_CG8, en_CG9, en_CG11	L05-LO6	EC4-EC6	CAT2	20%
en_CG4, en_CG6, en_CG9, en_CG11, en_CI9	LO1-LO6	EC1-EC6	FA1-FA5, [HD]	10%
en_CG4, en_CG6, en_CG9, en_CG11, en_CIB5	LO2-LO4	EC2-EC3	PD	30%
en_CG4, en_CG6, en_CG9, en_CG11, en_CIB5, en_CI9	LO1-LO6	EC1-EC5	GAT	20%

It is required to pass the subject, in continuous assessment, to pass at least 3 practices of 4, as well as pass the practices exam.

As a general rule, those students in ordinary session that not submitted to the evaluation of 2 practices and at least 2 following activities will get a mark of "NOT ATTENDED".

Ordinary exam – Final Exam

Learning Outcomes	Evaluation Criteria	Assessment Tools	Assessment Tools	Weight in Mark	
en_CG4, en_CG6, en_CG8, en_CG9, en_CG11, en_CIB5, en_CI9	LO1-LO6	EC1-EC6	GAT	100%	

Extraordinary exam - Final exam

Competences	Learning Outcomes	Evaluation Criteria	Assessment Tools	Weight in Mark
en_CG4, en_CG6, en_CG8, en_CG9, en_CG11, en_CIB5, en_CI9	LO1-LO6	EC1-EC6	GAT	70%
en_CG4, en_CG6, en_CIB5, en_CI9	LO2-LO4	EC2-EC3	PD	30%

6. BIBLIOGRAPHY

6.1. Basic Bibliography

- Computer Architecture, a quantitative approach. Sixth Edition John L. Hennessy, David A. Patterson. 2019
- Computer Organization and Architecture. William Stallings. Eighth Edition. 2011

6.2. Additional Bibliography

Computer Organization and Design RISC-V Edition. John L. Hennessy, David A. Patterson. 2018
Estructura y diseño de computadores. David A. Patterson, John L. Hennessy. 4ª Edición. 2011.
Lenguaje ensamblador para computadoras basadas en Intel. 5ª Edición. 2008.
Organización de Computadores. Carl Hamacher, Zvonko Vranesic y Safwat
Zaky. McGraw Hill, 2003.
Structured Computer Organization. Andrew S. Tanenbaum. Prentice Hall, 4th edition, 1999.

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.