Microprocessors

Academic Year: (2020 / 2021) **Review date: 10-07-2020**

Department assigned to the subject: Electronic Technology Department

Coordinating teacher: PATON ALVAREZ, SUSANA

Type: Electives ECTS Credits : 6.0

Year : 4 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

The lecturers strongly advises students who want to take this course have previously studied
"Programming"
"Digital Electronics"
"Electronic Instrumentation I"

OBJECTIVES

By the end of this content area, students will be able to have:
1. coherent knowledge of their branch of engineering including some at the forefront of the branch in microprocessors and embedded systems;
2. the ability to apply their knowledge and understanding of microprocessors and digital electronics to identify, formulate and solve engineering problems using established methods;
3. the ability to apply their knowledge and understanding to develop and realise designs based on small embedded sytems to meet defined and specified requirements;
4. an understanding of design methodologies to set and program microcontroller peripherals, and an ability to use them.
5. workshop and laboratory skills.
6. the ability to select and use appropriate equipment, tools and methods for the development of embedded systems;
7. the ability to combine theory and practice to solve problems of microprocessor based digital systems;

DESCRIPTION OF CONTENTS: PROGRAMME

1. Introduction to microprocessor based digital systems
2. Architecture of a microprocessor/microcontroller system.
   2.1. Central Processing Unit (CPU).
   2.2. Memory Structure.
   2.3. Interface Modules.
3. Machine level programming: Assembler.
   3.1. Machine instructions and addressing modes.
4. Software Development: Integrated Development Environment
   4.1. C language integrated development environment.
   4.2. Peripherals I/O Libraries
5. General Input/Output Pins
6. Analog/Digital and Digital/Analog Conversion
7. Exceptions and Interrupt Systems
8. Timers
9. Serial Asynchronous Communication
10. Serial Synchronous Communication
11. Additional functionalities: RTC, Watchdog, Power consumption, etc.
12. System design examples and analysis

LEARNING ACTIVITIES AND METHODOLOGY

The above course competences and skills provide skills within the program outcomes, through different activities. For each program outcome, we briefly describe the activities provided within the course:
- In the course, exercises are held where students have to complete/develop their programs to meet requirements. They are asked to interpret electronic circuit schematics, block diagrams and flowcharts.

- The course includes a laboratory design exercise, with an initial set of specifications that the students must meet by the end of the term. The problem is a manageable version of an electronic system design, where the students must solve using the given resources (Microcontroller Development Board, Debugger, peripherals).
- Design and analysis examples are presented to the students as guidance on good programming practices and electronic design techniques, showing how to apply specific peripherals to solve different problems.
- The students must be able to comment their program code appropriately, develop program flow diagrams, use schematic capture programs for their designs. This will be evaluated comprehensively in laboratory works.
- The students are required to work using engineering tools such as a Microcontroller Integrated Development Environment (IDE) program, use a Development Board, as well as a Debugger.
- The students carry out a final design project to apply what they have learned. At the end of the course they present a technical report and perform an oral exam about the project

ASSESSMENT SYSTEM

The evaluation of the course will be based on the following criteria:
1.- Partial evaluation throughout the semester, with a total weight of 10% of the final mark.
2.- Compulsory laboratory exercises, evaluating the progress achieved, with a total weight of 30% of the final mark. The evaluation of this part will be weighted by complexity and will contain an individual exam. The lack of participation in any of the laboratory sessions, without a legally valid justification, will impose the denial on using the Continuous Evaluation system. In 2020/2021 academic year, 5 of the 6 practices will be carried out in synchronous online format with material purchased by the student, and 1 practice will be carried out in person in the department laboratories.
3.- Technical report and video demonstrating the operation of the final project 20%
4.- Oral final exam, with a weight of 40%, in which the final project is defended and in which a minimum grade is applied to pass the course of 4 points out of 10.

% end-of-term-examination:	60
% of continuous assessment (assigments, laboratory, practicals…):	40

BASIC BIBLIOGRAPHY

- Development system manufacturer Development system manual, Development system manufacturer.
- Lecturers Collection of exercises , UC3M - Electronics Technology Department.
- Lecturers Collection of notes, slides and additional documentation, UC3M - Electronics Technology Department.
- Microcontoller Manufacturer Microcontroller datasheet, Microcontoller Manufacturer .

ADDITIONAL BIBLIOGRAPHY

- [Clements] Alan Clements Principles of Computer Hardware, Oxford University Press.