Microprocessor based digital systems

Academic Year: (2019 / 2020) **Review date: 04-05-2020**

Department assigned to the subject: Department of Electronic Technology

Coordinating teacher: PORTELA GARCIA, MARTA

Type: Compulsory ECTS Credits : 6.0

Year : 2 Semester : 2

STUDENTS ARE EXPECTED TO HAVE COMPLETED

The lecturers strongly advises students who want to take this course have previously studied both "Digital Electronics" and "Electronic Components and Circuits". "Digital Electronics" covers combinational and sequential digital electronics, acquiring knowledge about the digital building blocks. The second, "Electronic Components and Circuits", it is important to know the basic electronic components and electronic wiring plate or breadboard test and evaluate its operation using basic tools and laboratory equipment.
Other subjects that can help students for this course are "Systems and Circuits", which addresses the differences between discrete-time systems and continuous time systems, and "Systems Architecture", which covers the C programming language the development of a project.

COMPETENCES AND SKILLS THAT WILL BE ACQUIRED AND LEARNING RESULTS.

CB1 That students have demonstrated knowledge and understanding in a field of study that part of the basis of general secondary education, and is typically at a level which, although it is supported by advanced textbooks, includes some aspects that imply knowledge of the forefront of their field of study
CB2 That students can apply their knowledge to their work or vocation in a professional manner and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study.
CG3 Knowledge of basic materials and technologies that will enable you to learn new methods and technologies and that will equip you with the versatility to adapt to new situations.
CG13 understanding and mastery of the basic concepts of linear systems and related functions and transforms, theory of electrical circuits, electronic circuits, physical principles of semiconductors and logic families, electronic and photonic devices, materials technology and its application to solve own engineering problems.
ECRT9 Capacity for analysis and design of combinational and sequential circuits, synchronous and asynchronous, and use of microprocessors and integrated circuits.
ECRT10 Knowledge and application of the basics of description languages, hardware devices on computers with conventional architectures, sequential, parallel and multiprocessing type.

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.

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.
3.- Final exam, with a total weight of 60% of the final mark. To pass the subject, a minimum mark of 4 over 10 is requested in the final exam.

% 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 , Microcontroller Manufacturer.

ADDITIONAL BIBLIOGRAPHY

- [Clements] Alan Clements Principles of Computer Hardware, Oxford University Press, 2006