Digital electronic systems

Academic Year: (2022 / 2023) **Review date: 20-05-2022**

Department assigned to the subject: Electronic Technology Department

Coordinating teacher: PATON ALVAREZ, SUSANA

Type: Electives ECTS Credits : 6.0

Year : 4 Semester :

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Programming, Industrial Automation, Electronics Engineering Fundamentals, Electronic Instrumentation, Digital Electronics

OBJECTIVES

By the end of this subject, students will be able to have:
1. The ability to apply their knowledge and understanding to identify, formulate, and solve engineering problems using established methods.
2. The ability to apply their knowledge to develop and carry out designs that meet specific requirements
3. Technical and laboratory skills.
4. The ability to select and use appropriate equipment, tools and methods

The teaching objectives are:
- Knowing in detail the basic architecture of a reference CPU for embedded systems
- Knowing the different levels of abstraction in the definition of functions and specifications of an embedded system
- Knowing the interrupts subsystem, the timing subsystem, and the input/output subsystems of a reference microcontroller.
- Being able to program libraries for the use of specific peripherals, sensors and actuators, according to a technical user manual
- Being able to analyze the hardware-software set of a simple embedded system
- Being able to allocate resources and conceive at system level the hardware-software set of a simple embedded system
- Being able to implement signal processing functions and sequencers in embedded systems
- Knowing the principles of real-time operation of an embedded system

DESCRIPTION OF CONTENTS: PROGRAMME

1. Introduction to Digital Systems and Embedded systems. Basic concepts.
2. Fundamentals of Computer Architecture
3. Microprocessors:
- Memory organization, addressing modes and instruction set
- Input / output subsystems. Structure, Control and Addressing
- Event management and Interruption System
4. Microcontrollers:
- Real-time programming
- Parallel Input / Output Subsystems and External Interruptions
- Timing subsystems:
- time control
- generation and capture of binary signals
- Analog inputs / outputs
- Serial communication subsystems (USART, I2C, SPI)
5. Design of embedded systems:
- Development environment
- Practical cases

LEARNING ACTIVITIES AND METHODOLOGY

The teaching methodology will include:
- Magisterial Classes, where the students will be presented with the basic knowledge they must acquire. Students will be supplied with lecture notes and key reference texts which will enable them to complete and acquire a more in depth knowledge of the subject.
- Problems Classes, these are aimed at the solving of exercises and examples within the context of real case studies. These classes will be complimented with the resolution of practical exercises on behalf of the student.
- Laboratory Practical Sessions
- Group tutorials

ASSESSMENT SYSTEM

A mixed system has been chosen between continuous evaluation and finalist evaluation. The continuous evaluation consists of:
- Six practical laboratory sessions where students will design, build and evaluate a simple embedded system based on a set of specifications. The assessment will be carried out by checking a series of practical milestones and an individual practical exam (30%)

- A midterm exam on microprocessor systems (20%)

The final exam will consist of an analysis exercise and an embedded system design exercise with a weight of 50%, and a minimum mark of 3.5 out of 10

% end-of-term-examination:	50
% of continuous assessment (assigments, laboratory, practicals…):	50

BASIC BIBLIOGRAPHY

- Donald Norris. Programming with STM32: Getting Started with the Nucleo Board and C/C++., McGraw Hill Professional, , 2018
- Hennessy, John L ; Patterson, David A . Computer Architecture: A Quantitative Approach. , San Francisco: Elsevier Science & Technolog1, 2011
- Sarmad Naimi, Muhammad Ali Mazidi, Sepehr Naimi. The STM32F103 Arm Microcontroller and Embedded Systems: Using Assembly and C., MicroDigital Ed., 2020

ADDITIONAL BIBLIOGRAPHY

- Dogam Ibrahim ARM-based Microcontroller Projects Using mbed. , Newnes Elsevier., 2019