

Academic Year: ( 2023 / 2024 )

Review date: 16-03-2023

Department assigned to the subject: Electronic Technology Department

Coordinating teacher: HERNANDEZ CORPORALES, LUIS

Type: Electives ECTS Credits : 6.0

Year : 4 Semester : 2

**REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)**

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**OBJECTIVES**

Upon successful completion of this subject, students will be able to have:

1. the ability to apply their knowledge and understanding of digital systems and microprocessors to identify, formulate and solve engineering problems using established methods;
2. the ability to apply their knowledge and understanding to develop and realise designs of embedded systems to meet defined and specified requirements;
3. an understanding of design methodologies to develop applications and algorithms in embedded systems, and interfaces with sensors, actuators, and auxiliary circuits, and an ability to use them.
4. workshop and laboratory skills.
5. the ability to select and use appropriate equipment, tools and methods for the development of embedded systems;
6. an understanding of applicable techniques and methods in digital electronics and microprocessors, and of their limitations;

**DESCRIPTION OF CONTENTS: PROGRAMME**

Lesson 1: Description of the microprocessor to be used in the laboratory

- 1.1 CPU Architecture
- 1.2 Digital Input and Output
- 1.3 Interrupts
- 1.4 A / D and D / A Converters

Lesson 2: Structure of a real-time embedded application

- 2.1 real-time operating systems
- 2.2 Periodic interrupts (ticker)
- 2.3 interface with data conversion circuits
- 2.4 PWM signal generation

Lesson 3: Example of a sampled control system in real time

- 3.1 discrete equivalent of an analog integrator
- 3.2 Generalization of a control systems with discrete systems
- 3.3 Example of analog PI controller and its digital equivalent

Lesson 4: Description of the projects to be undertaken

- 4.1 Project Development Activity
- 4.2 Evaluation and documentation of results

**LEARNING ACTIVITIES AND METHODOLOGY**

The purpose of this subject is to integrate all the knowledge on electronics that has been taught during the degree by the development of a lab project. This project includes a microprocessor, some sensor signal conditioning and requires to develop an embedded real time application software.

The subject is composed of a first block of lectures to review all necessary matters and to explain the projects. (2 ECTS). Afterwards, the lab exercise is developed in the lab (4ECTS) supported by group and individual tuition.

**ASSESSMENT SYSTEM**

The final target of this topic is the hardware and software development of an electronic system involving a microprocessor, analog/digital interface circuits, sensors and actuators. During the course, the students will work in small groups and a specific project will be assigned to each group. . Each project

has 6 milestones to develop that will be evaluated by the professor in the lab and small group lectures. The final mark will be composed by adding the evaluation of each of the milestones accomplished up to a maximum of 65%, a 10% will be a final report elaborated by the group and three reports for up to 15%. The final lab exam will have a weight of 10% . Those students not following the continuing assesment will have a final lab examination with 85% of worth.

<b>% end-of-term-examination:</b>	10
<b>% of continuous assessment (assigments, laboratory, practicals...):</b>	90

#### BASIC BIBLIOGRAPHY

- Gaonkar, Ramesh S. Fundamentals of microcontrollers and applications in embedded systems , Thomson/Delmar Learning,, 2007
- M.A. Perez Garcia, J.C. Alvarez Anton, J.C. Campo Rodriguez, F.J. Ferrero Martin, G.J. Grillo Ortega Instrumentacion Electronica, Thomson - Paraninfo, 2003
- Sedra, Adel S Circuitos microelectrónicos, McGraw-Hill Interamericana, 2006