Embedded systems

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

Department assigned to the subject: Electronic Technology Department

Coordinating teacher: GARCIA VALDERAS, MARIO

Type: Electives ECTS Credits : 3.0

Year : 1 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Microprocessors

OBJECTIVES

COMPETENCES:
- Know how to apply the acquired knowledge and their ability to solve problems in new or little-known environments within broader (or multidisciplinary) contexts related to their area of study.
- Prepare concise, clear and reasoned documentation and specify the work to be carried out for the development, integration and application of complex electronic systems with high added value.
- Conceive, design, implement and maintain an electronic system in a specific application.
- Acquire teamwork skills integrating multidisciplinary approaches.
- Adopt the scientific method as a fundamental work tool to be applied in both professional and research fields.
- Ability to design electronic systems both at the conceptual level, based on specific specifications, and at the system level, using modeling and simulation tools, and at the subsystem level, using, among others, hardware description languages.
- Ability to handle advanced tools, techniques and methodologies for designing electronic systems or subsystems.
- Ability to design a device, system or application that meets given specifications, using a systematic and multidisciplinary approach and integrating advanced modules and tools that are specific to the field of Electronic Engineering.
- Ability to identify merit factors and effective comparison techniques to obtain the best solutions to scientific and technological challenges in the field of Electronic Engineering and its applications.
- Ability to apply optimization techniques for the development of electronic circuits and subsystems.

LEARNING OUTCOMES:
After passing this subject, students should be able to:
- Know the different types of embedded systems and their fields of application, including those based on reconfigurable devices.
- Know the differences between a reconfigurable digital system and a microprocessor-based digital system, and evaluate for each application the use of each one or the integration of both in an embedded system.
- Know and exploit the advantages and disadvantages of developing an embedded system, using a platform based on a generic operating system.
- Know development tools for embedded systems.
- Use a specific development tool to describe and program a microcontroller-based digital system embedded in a reconfigurable device.

DESCRIPTION OF CONTENTS: PROGRAMME

Embedded systems are digital processing and computation systems that are in charge of a certain number of specific functions, and usually working in real time. They can be implemented in a variety of ways, including the use of microcontrollers, or embedding microprocessors in a reconfigurable device. In this subject the different available technologies for developing embedded systems will be described. The student will learn how to evaluate and compare which of the different development approach is more suitable for a certain application. It will also be taught how to identify and specify the real-time processing functions, and their hardware-software efficient implementation.

1. Introduction to embedded systems
   - Embedded systems introduction and main features
   - Types
   - Design challenges

2. Hardware component
 - Typical architecture
 - Inputs and outputs types
 - Processing unit
3. Software component
 - Necessary tools
 - Standalone applications
 - Operating Systems
4. Embedded systems in FPGA
 - Embedded microprocessors in Xilinx FPGAs
 - Xilinx design environment for embedded systems
 - Operating systems
 - Debugging and validation
5. Resource optimitazion
 - Critical parameters
 - Evaluation and optimization techniques
  + Hardware/Software co-design
  + Hardware techniques
  + Software techniques

LEARNING ACTIVITIES AND METHODOLOGY

FORMATION ACTIVITIES
Theoretical classes
Practical classes
Theoretical practical classes
Laboratory practices
Tutoring
Team work
Individual work

TEACHING METHODOLOGIES
- Presentations in the teacher's class with the support of computer and audiovisual media, in which the main concepts of the subject are developed and the bibliography is provided to complement the learning of the students.
- Resolution of practical cases, problems, etc. raised by the teacher, to work individually or in groups
- Critical reading of texts recommended by the teacher of the subject: newspaper articles, reports, manuals and / or academic articles, either for later discussion in class, or to expand and consolidate the knowledge of the subject.
 -Preparation of works and reports individually or in groups

ASSESSMENT SYSTEM

Continuous assesment:
- Practical exercise to develop in the laboratory (in groups): 25%
- Proposed exercises 15%
- Final exam 60%

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

BASIC BIBLIOGRAPHY

- J. K. Peckol Embedded Systems: A Contemporary Design Tool, Wiley, 2008

- P. Marwedel Embedded System Design, Springer, 2nd edition, 2011