Universidad Zaragoza

Academic Year/course: 2024/25

30046 - Digital Electronic Systems

Syllabus Information

Academic year: 2024/25
Subject: 30046 - Digital Electronic Systems
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
Degree: 436 - Bachelor's Degree in Industrial Engineering Technology
ECTS: 6.0
Year: 4
Semester: First semester
Subject type: Optional
Module:

1. General information

The objective of the subject is to train the student in the fundamentals of the design of digital electronic systems based on FPGAs and microcontrollers to know how to control simple electrical and mechatronic systems: control of DC motors, servos, stepper motors.

2. Learning results

Knows the common digital electronic building blocks and is able to combine and use them.

Identifies and understands the basic structure and operation of FPGAs and microcontrollers as the most useful implementation technologies in industrial applications.

Designs FPGA-based digital electronic systems using the VHDL hardware description language.

Designs digital electronic systems based on microcontrollers and programs them in C and Python languages.

Uses with fluency the development tools of electronic systems based on FPGAs and microcontrollers.

Knows basic peripheral connection techniques.

Selects and applies digital electronic systems oriented to the control of power electronic converters applied to simple electrical and mechatronic systems.

3. Syllabus

T1. Introduction

- Programmable logic and microcontrollers
- Examples of industrial applications

T2. Microcontrollers

- Introduction to microcontrollers
- Basic blocks of a microcontroller
- Peripherals
- C and Python programming languages

T3. MSP430 Microcontroller

- CPU architecture
- Interruptions and Reset
- Clock system and modes of operation
- Digital I/O ports
- Timers
- ADC10 peripheral of the MSP430

T4. Description of digital circuits in VHDL

- Hardware description language VHDL
- Methodology, tools and design flow
- Combinational and sequential circuits
- Design rules

T5. Examples of digital design applied to industry

4. Academic activities

Lectures (30 hours)

Expository and explanatory sessions of contents.

Problem and case classes (15 hours)

In this activity a set of typical problems will be solved.

Laboratory practices (15 hours)

Physical implementation of representative examples will be carried out in the laboratory.

Teaching assignments (30 hours)

The student is expected to approach real cases by applying the techniques described throughout the term.

Study (54 hours)

Personal study aimed at achieving the proper monitoring of the subject, the completion of the practices, the preparation of the exam and tutorials.

Assessment tests (6 hours)

5. Assessment system

The subject will be assessed only in the **global assessment** modality by means of the following activities:

Test 1. Theoretical exam: grade from 0 to 10 points **(20% final grade**). There will be an individual written exam consisting of several multiple-choice or short-answer questions.

Test 2. Laboratory exam: grade from 0 to 10 points **(40% final grade**). Students who have obtained a practice grade of 4 points or more during the term will be exempted from this exam. The exam will consist of the implementation of digital circuits similar to those developed during the term in the laboratory practice sessions. The design methodology, the operation of the circuit and the use of the instruments and the software tools of the laboratory will be assessed.

Test 3. Oral presentation of the practical work: grade from 0 to 10 points **(40% final grade**). The assessment of the works will take into account both the report presented and the suitability and originality of the proposed solution.

6. Sustainable Development Goals

3 - Good Health & Well-Being
9 - Industry, Innovation and Infrastructure
11 - Sustainable Cities and Communities