Digital systems applied to electrical power engineering

Academic Year: (2023 / 2024) **Review date: 09/05/2023 14:16:36**

Department assigned to the subject: Electronic Technology Department

Coordinating teacher: FERNANDEZ HERRERO, CRISTINA

Type: Electives ECTS Credits : 6.0

Year : Semester :

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Electronics Engineering Fundamentals
Industrial Electronics

LEARNING OUTCOMES

CB1. Students have demonstrated possession and understanding of knowledge in an area of study that builds on the foundation of general secondary education, and is usually at a level that, while relying on advanced textbooks, also includes some aspects that involve knowledge from the cutting edge of their field of study.
CB2. Students are able to apply their knowledge to their work or vocation in a professional manner and possess the competences usually demonstrated through the development and defence of arguments and problem solving within their field of study.
COCIN4. Ability to resolve problems with initiative, decision-making, creativity, and critical reasoning skills and to communicate and transmit knowledge, skills and abilities in the Industrial Engineering field.
CEP1. Capacity to design a system, component or process in the area of electrical engineering in compliance with required specifications.
CEP2. Knowledge and ability to apply computational and experimental tools for analysis and quantification of electrical engineering problems.
CEP3. Ability to design and carry out experiments to analyze and interpret data obtained.
CER5. Knowledge of the fundamentals of electronics.

By the end of this content area, students will be able to have:
RA1.3. Coherent knowledge of the branch of electrical engineering including some at the forefront of their branch in digital electronics.
RA2.3. The ability to select and apply relevant analytic and modelling methods in digital electronics.
RA3.1. The ability to apply their knowledge and understanding to develop and realise designs to meet defined and specified requirements.
RA4.2. The ability to design and conduct appropriate experiments, interpret the data and draw conclusions.
RA4.3. Workshop and laboratory skills.
RA5.1. The ability to select and use appropriate equipment, tools and methods for digital electronic systems.

OBJECTIVES

The objective of this course is to provide students with a general knowledge of digital systems applied to system control applications related to electrical engineering. Students will achieve the following skills:
- Knowledge of the basic principles of operation of digital circuits and systems.
- Knowledge of the design methodology and management of basic tools for the development of digital systems.
- Ability to use digital systems in system control applications related to electrical engineering.

DESCRIPTION OF CONTENTS: PROGRAMME

1. INTRODUCTION
  1.1 Course organization
  1.2. Introduction to digital systems applied to Electrical Engineering
    1.2.1. Digital systems in electrical power systems management
    1.2.2 Digital control for power systems, power converters and electrical machines
2. DIGITAL SYSTEMS I
  2.1. COMBINATIONAL SYSTEMS
    2.1.1. Combinational Logic (review). Number systems and information conding
    2.1.2. Combinational circuits
    2.1.3. Design of combinational circuits
    2.1.4. Binary arithmetic
    2.1.5. Arithmetic combinational circuits
  2.2. SYNCHRONOUS SEQUENTIAL CIRCUITS
    2.2.1. Registers and counters
    2.2.2. Introduction to Finite State Machines
3. DIGITAL SYSTEMS II
  3.1 DIGITAL SYSTEMS BASED ON MICROCONTROLLER and MICROPROCESSORS
    3.1.1. Architecture and main elements, memory
    3.1.2 Programming model
    3.1.3 Introduction to C language
  3.2 REFERENCE MICRONCONTROLLER
    3.2.1 Architecture overview
    3.2.2. Development environment
    3.2.3. Peripherals
    3.2.4. Interrupts

LEARNING ACTIVITIES AND METHODOLOGY

- Lectures to introduce the knowledge that students must acquire. Students will receive class slides and will have basic reference texts to reinforce those topics they are most interested in.
- Practical classes to solve exercises and the practical development of the contents presented in the lectures.
- Laboratory sessions, where the student designs, assembles and experiments a digital system.
- There is the possibility of holding a group tutoring session.

ASSESSMENT SYSTEM

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

The evaluation of the subject is based on reports containing the solution to exercises based on the activities developed during the classes, and an end of term exam.
The content of the reports is the following:
  - Report 1: design, implementation and characterization of a digital system based on an FPGA.
  - Report 2: design, implementation and characterization of a digital system based on a microcontroller.

The final grade of the subject will be calculated as follows:
  - Option A: 0.4*Report1+0.6* Report2
  - Option B: 0.4*Reports+0.6*Exam

BASIC BIBLIOGRAPHY

- Thomas L. Floyd Digital fundamentals, Pearson Prentice Hall.

- null Reference manual and supplementary material provided by the manufacturer for the microcontroller, Manufacturer, 2021

ADDITIONAL BIBLIOGRAPHY

- KUO, BENJAMIN C. "Digital Control Systems ", Oxford University Press, USA; 2 edition (June 1995).

- Brian W. Kernighan, Dennis M. Ritchie The C programming language, Prentice Hall, 1978