DIGITAL ELECTRONIC SYSTEM

Academic Year: 5th (Opt.) Semester:2nd No of Credits: 6, ECTS: 5 Code: 2330
Department: Electronics Technology, Systems and Automation Engineering
Professors: Francisco Javier Azcondo, Christian Brañas
Recommended background: Electronics Systems, Further Electronics Systems, Electronic Devices and Circuits, Further Industrial Electronics

GENERAL OBJECTIVES

This course presents practical approaches in order to equip the students with competences to design and implement medium complexity digital electronic circuits using programmable logic devices, emphasizing the following points:

- To know the computer aided design framework; text and graphical interfaces.
- To determine the fundamental tasks that the designer must carry out to achieve reliable designs.
- To know the syntax of the principal elements of the language of description of hardware VHDL.
- To analyze, synthesize and simulate simple combinational and sequential designs applying using VHDL.
- To practise the basic concepts of the Digital Electronics by means of VHDL use.
- To select the adequate logical programmable device depending on the technical needs of an application.
- To recognize the strategy most adapted for the description of finite state machines with VHDL.
- To adapt the designs for the implementation on the logical programmable devices
- To analyze, synthesize and simulate synchronous digital designs.
- To identify and face the clock distribution problems when developing a digital design.
- To define, to plan and to realize a functional test of a digital synchronous design.

SYLLABUS

1. Introduction: Hardware description languages. Short history. Hardware vs. software. Hardware model. Design process methodology. Description styles
2. Basic elements: Lexical elements. Objects. Data types. Operator and expressions. Attributes
3. Design units: Overview of the design units. Entities. Architectures. Configurations. Packages. Libraries
4. Sentences: Sequential vs. concurrent . Sequential sentences. Concurrent sentences. Subprograms
5. Practical design – elements: Basic logic gates. Behavior vs. RTL. Combinational logic. Combinational components. Latch & Flip-flops. Memories. Sequential components. Sequential logic design. Signal vs. variable
6. Design project: Design of a circuit with practical application and implementation.

BIBLIOGRAFY

1. Edward J. McCluskey. Logic Design Principles. Prentice Hall International Editions
2. John P. Hayes. Introduction to digital Logic Design. Addison Wesley
3. T.L. Floyd. Fundamentos de Sistemas Digitales. Prentice Hall
4. Daniel D. Gajski. Principios de Diseño Digital. Prentice Hall. Prentice Hall
5. Randy H. Katz. Contemporary Logic Design. Benjamin Cummings
6. Lluís Terés, Yago Torroja, Serafín Olcoz, Eugenio Villar VHDL Lenguaje estándar de diseño Electrónico. Mc. Graw Hill
7. Douglas Perry. VHDL Second Edition. Mc Graw Hill
8. Jesse H. Jenkinns. Designing with FPGAs y CPLDs. Prentice Hall
9. P.K. Chan / S. Moured Digital design Using Field Programmable Gate Arrays. Prentice Hall

ASSESMENT CRITERIA

In November the students receive the design specifications of a circuit to be implemented in a FPGA and a PIC microcontroller. Based on the student's report, circuit performance in comparison with the specifications, optimization of the circuit resources and oral presentation the mark is given according to the following general criteria:
No satisfactory solution: fail
Simulation of the basic performance: C
Implementation in FPGA / PIC: B
Verified contributions to improve the circuit performance: A