

Academic Year: ( 2019 / 2020 )

Review date: 30-04-2019

Department assigned to the subject: Electronic Technology Department

Coordinating teacher: GARCIA VALDERAS, MARIO

Type: Electives ECTS Credits : 6.0

Year : 4 Semester : 1

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

- Electronics Engineering Fundamentals (2nd)

**OBJECTIVES**

- Capability to design combinational and sequential digital circuits.
- Understand digital design methodology and gain experience with tools for design and debugging digital systems
- Basic understanding of the principles of digital system design at the register-transfer level
- Knowledge of semiconductor memories and programmable logic devices
- Basic knowledge of microprocessors and microcontrollers. Capability to develop simple applications using microcontrollers.

**DESCRIPTION OF CONTENTS: PROGRAMME**

1. Introduction to design and implementation of digital circuits
  - Technologies for implementing digital circuits
  - Hardware description languages
  - Design flow: simulation and automatic synthesis
  - Basic concepts of VHDL design
2. Combinational circuits and VHDL description
  - Logic functions and boolean expressions
  - Basic logic gates
  - Multiplexers
  - Encoders and decoders
  - Comparators
  - Arithmetic circuits
3. Sequential circuits and VHDL description
  - Synchronous and asynchronous flip-flops: synchronous digital design
  - Registers and counters
  - Finite state machines
  - Memories
4. Simulation and synthesis of VHDL described digital circuits
  - VHDL for simulation and synthesis
  - Testbenches and simulation models
  - Synthesis. Resource usage and timing. Constraints
5. Digital circuit implementation
  - Programmable logic devices (FPGA)
  - Custom integrated circuits (ASIC)
  - Digital circuit design flow
6. Introduction to digital systems and microprocessors
  - Structure of a digital system: datapath and control
  - Typical components in a digital system
  - Digital System design at the Register-Transfer Level
  - Basic structure of a microprocessor
  - Operation of a microprocessor. Instructions
7. Study of a microcontroller
  - Internal architecture
  - Memory and register organization
  - Instruction set
  - Microcontroller programming. Development environment
8. Peripherals

- Types of inputs and outputs
- General purpose parallel I/Os
- Timers
- Methods for communication with peripherals. Interrupts

#### LEARNING ACTIVITIES AND METHODOLOGY

- Lectures: 1 session/week (2 h.)
- Practice: 1 session/week (2 h.)
- Lab. Practice: 4 sessions, 3 h. each
- Personal assistance, as scheduled by the professor

#### ASSESSMENT SYSTEM

Continuous evaluation system based on:

- 1st partial exam: Units 1-5. Value: 20%
- 2nd partial exam: Units 6-8. Value: 20%
- Lab Practice Work (compulsory): 15%
- Final exam: Value: 45%

<b>% end-of-term-examination:</b>	<b>45</b>
<b>% of continuous assessment (assignments, laboratory, practicals...):</b>	<b>55</b>

#### BASIC BIBLIOGRAPHY

- R. Tokheim Digital Electronics, McGraw-Hill.
- null FPGA Manufacturers web pages. Xilinx: [www.xilinx.com](http://www.xilinx.com); Altera: [www.altera.com](http://www.altera.com); , .., Various.
- Bryan Mealy, Fabrizio Tappero Free Range VHDL. The no-frills guide to writing powerful code for your digital implementations, ., 2013
- Smith, D.J. HDL chip design, Doone, 1997
- T. L. Floyd Digital Fundamentals, Prentice-Hall.

#### ADDITIONAL BIBLIOGRAPHY

- D. D. Gajski Principios de Diseño Digital, Prentice-Hall.
- J. F. Wakerly Digital Design Principles and Practices, Pearson Education.