Digital Electronics

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 :

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
   - Aritmethic 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 decribed 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%

% end-of-term-examination:	45
% of continuous assessment (assigments, laboratory, practicals…):	55

BASIC BIBLIOGRAPHY

- R. Tokheim Digital Electronics, McGraw-Hill.
- null FPGA Manufacturers web pages. Xilinx: www.xilinx.com; Altera: 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.