Computer Technology

Academic Year: (2019 / 2020) **Review date: 05-05-2020**

Department assigned to the subject: Electronic Technology Department

Coordinating teacher: ENTRENA ARRONTES, LUIS ALFONSO

Type: Basic Core ECTS Credits : 6.0

Year : 1 Semester : 2

Branch of knowledge: Engineering and Architecture

OBJECTIVES

The general objective of this course is to understand the basic building blocks of digital electronics and the operation of combinational and sequential circuits that are used inside a computer.

To achieve this goal, the following competences will be acquired:

1. BASIC COMPETENCES

CB1

Students have demonstrated knowledge and understanding in an area of studies that is the part of the base of general secondary education, and is typically at a level, that, whilst supported by advanced textbooks, includes some aspects that will imply the knowledge of the forefront of their field of study.

In secondary school Industrial Technologies II is studied. They studied
- Numbering systems
- Boolean Algebra
- Combinational circuits
- Sequential circuits (flip-flops)

Much of the course is devoted to this: 60%.
Topics 1-6.
It is evaluated in all the tests

2. GENERAL COMPETENCES

CGB2

Understanding and mastering the basics of fields and waves and electromagnetism, electrical circuit theory, electronic circuits, basic principles of semiconductors and logic families, electronic and photonic devices, and its application for solving problems of engineering

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Digital electronic circuits are studied: Logic gates, flip-flops, PLDs and memory, and its application to solving problems.
Topics 4, 7, 9, 10
Assessed in exam (memories, PLDs and application) and practices (applications).

CGB5

Knowledge of the structure, organization, operation and interconnection of computing systems, the basics of programming and its application to solving engineering problems

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Topics 1, 9 and 11: structure of computers, connection
Assessed in exam (problems of memories, questions on the system under test)

3. COMMON COMPETENCES
CERCI1
Ability to design, develop, select and evaluate applications and computing systems, ensuring their reliability, safety and quality, according to ethical principles and the legal and regulatory norms

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Practice 4 (application) and exam (design exercise)

DESCRIPTION OF CONTENTS: PROGRAMME

Keywords:
Information representation and coding; Boolean Algebra; logic functions; logic gates; combinational circuits; sequential circuits; registers; memories; programmable logic devices.

Syllabus:
1. Introduction to digital systems
   - Information representation in digital systems
   - The computer as a digital system
2. Number systems
   - Decimal, binarty, octal, hexadecimal
   - Conversions
   - Binary codes
3. Binary arithmetic
   - Unsigned binary arithmetic
   - Signed binary arithmetic
   - Integer and real number representation
   - Number precision and accuracy
   - Addition, multiplication
   - Floating point arithmetic.
4. Boolean Algebra and logic gates
   - Postulates and main properties fo Boole Algebra
   - Functions and boolean expressions
   - Logic function implementation. Logic Gates
   - Logic function minimization: Karnaugh maps
5. Combinational circuits. Logic families
   - Encoders
   - Decoders
   - Multiplexers
   - Demultiplexer
   - Comparators
   - Adder and substractor circuits
   - Multiplier circuit
   - Arithmetic and logic unit (ALU)
6. Latches and Flip-flops
   - Introduction. The flip-flop as basic memory element
   - D latch
   - Synchronous flip-flops
   - Asyncronous inputs ins synchronous flip-flops
   - T flip-flop
   - Flip-flop chronograms
7. Synchronous sequential circuits
   - Introduction to syncronous circuits
   - Finite state machines: Moore and Mealy models
   - Synchronous sequential cictuit analysis
   - Synchronous sequential cictuit synthesis
8. Registers and counters
   - Registers
   - Counters
9. Memories
   - Introduction. Types of memories
   - Memory internal structure
   - Random access memories (RAM)
   - Read only memories (ROM)
   - Word and size memory expansion
   - Memory access: chronograms
   - Other memory applications
10. Programmable Logic Devices (PLD)
   - PLD classification
   - Programmable logic arrays (PAL, PLA)
   - High capacity programmable logic devices: CPLD, FPGA
   - Methodology and tools for PLD design

11. Introduction to digital systems and microprocessors
   - Digital systems structure: datapath and control
   - Elemental computer structure
   - Elemental computer operation. Instructions

LEARNING ACTIVITIES AND METHODOLOGY

1. Lectures: 1 ECTS. Intended to reach the specific competences of the course. Students will receive class notes and reference books in order to work and get in-depth knowledge on the course contents. (PO: a,b,c,e,k)
2. Practice: 1 ECTS. Design and development of digital circuits with the aid of the professor. Intended to develop the procedural competences and most of the general competences. They will also contribute to develop the attitudinal competences.
3. Student work: 3.5 ECTS
   - Exercises and complementary lectures proposed by the professor.
   - Personal study
4. Exercises and exam: 0.5 ECTS

ASSESSMENT SYSTEM

The objective of the evaluation is to measure the achievement. Student's work will be evaluated continuously through exercises and exams, practical work and other academic activities, with the following weights:

Partial exam (CB1): 35%
Lab Practice (CB1,CGB2,CECRI1): 25% (assistance is compulsory)
Final Exam (CB1,CGB2,CGB5,CECRI1): 40% (minimum score required)

For those students not taking the continuous assessment system, the final exam will represent 60% of the total mark in the ordinary exam, and 100% in the extraordinary exam.

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

BASIC BIBLIOGRAPHY

- FLOYD, T.L. "Fundamentos de Sistemas Digitales (Digital Systems Fundamentals)", Prentice-Hall.
- HAYES, J.P. "Introducción al Diseño Lógico Digital (Introduction to Digital Logic Design)", Addison-Wesley.