Computer Technology

Academic Year: (2019 / 2020) **Review date: 08/05/2020 12:32:53**

Department assigned to the subject: Electronic Technology Department

Coordinating teacher: SAN MILLAN HEREDIA, ENRIQUE

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 related to the program outcomes will be acquired:

1.General competences:
- Analysis and synthesis capabilities (PO: b,e).
- Organization and planning capabilities (PO: b,c,d)
- Problem solving (PO: a,c,e)
- Team work (PO: d)
- Capabilities to put knowledge in practice (PO: a,b,c,e,k)

2.Specific competences
a) Specific knowledge (PO: a,b,c,e,k)
- Number systems and coding systems commonly used in a computer
- Concept and implementation of a combinational circuit
- Concept and implementation of a sequential circuit
- Circuits and logic families used to implement digital circuits
- Main types of memory commonly used in a computer

b) Procedural competences (PO: a,b,c,e,k)
- Combinational circuit design
- Sequential circuit design
- Memory map design
- Use Programmable Logic Devices for the implementation of digital circuits

c) Attitudinal competences (PO: a,c,d,e)
- Capability to generate new ideas (Creativity)
- Motivation for digital circuit quality
- Motivation for achievement
- Interest for research and development of solutions to new problems related with computer technology

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
    - Introduction to digital systems and microprocessors
11. 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. (PO: a,b,c,d,e,k)

3. Student work: 3.5 ECTS (PO: a,b,c,d,e,k)
   - Exercises and complementary lectures proposed by the professor.
   - Personal study
4. Exercises and exam: 0.5 ECTS (PO: a,b,c,e)

ASSESSMENT SYSTEM

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

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:

1st. partial exam (PO a,b,c,e): 20%
2nd. partial exam (PO a,b,c,e): 25%
Lab Practice (PO a,b,c,d,e,k): 15% (assistance is compulsory)
Final Exam (PO a,b,c,e): 40% (minimum score required and defined at the beginning of the course)

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.

BASIC BIBLIOGRAPHY

- FLOYD, T.L. Fundamentals of Digital Systems, Prentice-Hall .