IPG Polytechnic of Guarda School of Technology and Management	**SUBJECT DESCRIPTION**	MODELO PED.013.02

Course	**Mechanical and Industrial Informatics**			*Academic year*	2021/2022		
Subject	**Digital Systems**			ECTS	6,5		
Type of course	**Compulsory**						
Year	**2nd**	*Semester*	**1st**	*Student Workload:*			
Professor(s)	**António Mário Ribeiro Martins**			*Total*	175,5	*Contact*	60
Area Coordinator	**Fernando José dos Santos Melo Rodrigues**						

Planned SD

1. LEARNING OBJECTIVES

Representing real numbers in different radix. The concepts of precision and complement. Obtaining a Boolean function from the truth table. Canonical forms. Boolean simplification using simple theorems. Design with multiplexers and decoders. Latch and registers description. Counter design. Explaining ROM and RAM. Expansion memory design. DAC design. Description of some general used ADC's.

2. PROGRAMME

Number basis. Representing real numbers in base 2, 8 and 16. Changing base. Operations in the referred basis.
Concept of precision and off complement- Codes.
Logic function: Inverter, AND and OR functions. Formal definition of Boolean algebra. Fundamental theorems. NAND, NOR and XOR functions. ´N' variables function. Normal canonical forms SOP and POS. Expression minimization.
Medium complexity combinatory modules: Decoders, encoders and multiplexers. ROM structured. Design with ROM.
SR latches D and JK master-slave flip-flop. Edge triggered D flip-flop. Basics registers. Shift registers. Interconnecting methods of register banks. Asynchronous counters and time diagrams. Synchronous counters.
Basic static RAM cell. Nx1 bit memory. Expansion for k words of M bits.
Digital to analogic conversion. Operational amplifiers. DAC and ADC most used circuits.

3. COHERENCE BETWEEN PROGRAMME AND OBJECTIVES

The representation and operation with rational numbers in different basis, demand the teaching of radix change between natural numbers first, operating in different basis from decimal base, changing base where one is a power off the other, and in the end the representation and operation of fractional numbers focusing on the representation error.
Representing numbers in the form of complement is teached first in decimal and then in binary. To design logic circuits the Boolean algebra is taughted, as well as Boolean simplification. Alternative design is considered, with medium complexity modules, such as multiplexers and decoders. Lathes and flip-flop are the basic elements to design registers and counters. The

expansion memory design demands learning the circuit description, of various types, in order to design memory expansion. Also in DAC design, and ADC understanding, it is only possible if the circuits are explained to the students.

4. MAIN BIBLIOGRAPHY

Arroz, Guilherme e outros; Arquitectura de Computadores, IST Press, 2a edição, 2009. ISBN: 978-972-8469-54-2

Sandige; Modern Digital Design, McGraw-Hill, 1990. ISBN-13: 978-0070548572

Morgado Dias; Sistemas Digitais, Princípios e Prática, FCA, 2010. ISBN: 9789727226504

H. Taub and D. Schilling; Digital Integrated Electronics, McGraw-Hill, 1977. ISBN-13: 978-0070857889

5. TEACHING METHODOLOGIES (INCLUDING EVALUATION)

Teaching methodology demands four types of lessons: expository, interactive, problem solving and work labs. The assessment is theoretical, with 65% weight, two test or one exam, and lab works weighting 35%. Final grade equal to or higher than 10 values to obtain approval, with 20 being the highest grade possible.

6. COHERENCE BETWEEN TEACHING METHODOLOGIES AND OBJECTIVES

In this subject, representing digital information is the goal, so the need for expositive and interactive lessons. Boolean Algebra is fundamental to understand digital design, so it needs the same kind of lessons. To understand sequential circuits, the students need typical circuits such as latches and flip flop. Lab assemblies allows the students to acquire these skills. Memory analysis began by a theoretical of memory cell allowing the understanding and design of memory expansion. Analog to digital conversion also demands expositive lessons, problem solving and assembling. Lab work is essential to an experimental validation off theories taught.

7. ATTENDANCE

N.A.

8. CONTACTS AND OFFICE HOURS

Professor: António Mário Ribeiro Martins (Ph.D); amrmartins@ipg.pt; office n.º 64

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