

## SUBJECT TEACHING GUIDE

### G826 - Digital Electronic Systems

#### Degree in Telecommunication Technologies Engineering

Academic year 2023-2024

1. IDENTIFYING DATA					
Degree	Degree in Telecommunication Technologies Engineering			Type and Year	Optional. Year 3
Faculty	School of Industrial Engineering and Telecommunications				
Discipline	Subject Area: Electronic Systems Design				
Course unit title and code	G826 - Digital Electronic Systems				
Number of ECTS credits allocated	6	Term	Semester based (2)		
Web	<a href="https://moodle.unican.es/">https://moodle.unican.es/</a>				
Language of instruction	Spanish	English Friendly	Yes	Mode of delivery	Face-to-face

Department	DPTO. INGENIERÍA INFORMÁTICA Y ELECTRÓNICA				
Name of lecturer	MIGUEL ANGEL MANZANO ANSORENA				
E-mail	<a href="mailto:angel.manzano@unican.es">angel.manzano@unican.es</a>				
Office	Facultad de Ciencias. Planta: + 2. DESPACHO DE PROFESORES (2054)				
Other lecturers	GUSTAVO A. RUIZ ROBREDO				

3.1 LEARNING OUTCOMES
- Knowing methodologies and alternatives for the design and implementation of digital circuits and systems.
- Use of some CAD tools widely used in digital electronic design.
- Mastering the use of hardware description languages for describing and synthesizing digital electronic systems with some complexity.
- Use of the electronic equipment for checking the operation of digital circuits.
- Properly use of EDA tools for the implementation of digital electronic systems using configurable electronic devices.

#### 4. OBJECTIVES

Introducing guidelines and methodologies to address the design of digital electronic systems.
Knowing the alternatives for digital circuit design, rating different aspects such as consumption, operating frequency, cost, reusability, time-to-market, etc.
Getting confident in handling CAD tools for the design and synthesis of digital systems based on programmable logic devices.
Knowing design optimization techniques in aspects such as consumption or operating speed.
Knowing strategies for verification of digital systems, as well as design techniques to make possible this task.
Learn techniques, develop skills, and use tools for design, implementation and verification of complex digital circuits suitable to be synthesized using programmable devices.

#### 6. COURSE ORGANIZATION

##### CONTENTS

1	VHDL and digital circuits. Data types. Objects. Operators. Statements. Functional units. VHDL for synthesis. Digital circuits with VHDL.
2	Introduction to digital systems design. Introduction to microelectronics and digital integrated circuits. Design methodologies. Design flow. EDA software.
3	Digital systems design. Register transfer methodology (RTL): principles and practice. Data path and control circuits. System verification. Implementation on FPGAs.
4	Synchronous design. Clock generation and distribution. Timing analysis. Data transfer between clock domains.
5	Digital circuit testing. Introduction to CMOS integrated circuits testing: fault models. Fault simulation and test pattern generation. Design for testability (DFT).

#### 7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
Laboratory work	Laboratory evaluation	No	Yes	25,00
Written exam concerning blocks 1, 2, 3 and 4.	Written exam	No	Yes	20,00
Written exam concerning block 5.	Written exam	No	Yes	30,00
Homework	Work	No	Yes	25,00
<b>TOTAL</b>				<b>100,00</b>
Observations				
Observations for part-time students				
Part-time students who are not able to attend the continuous assessment will be evaluated by written or practice exams.				

#### 8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC
Chu, P. P. "RTL hardware design using VHDL". John Wiley & Sons.
Roth, C. H. "Digital Systems Design using VHDL". PWS Publishing Company.

