

Program	09TT- Engineering in Telecommunication Technologies and Services
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Course number and name	
Number	95000026
Name	Digital Systems I Sistemas Digitales I
Semester	Y3 - S5

Credits and contact hours	
ECTS Credits	4.5
Contact hours	45

Coordinator's name	Ricardo de Córdoba Herralde
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Specific course information

Description of course content

This subject studies microprocessors/microcontrollers and their use in the design of electronic systems. It goes one step further in the study of digital circuits with a non studied case: programmable systems.

After presenting the basic concepts of computer architectures, we focus in a specific microcontroller, namely the Motorola ColdFire MCF5272, and use it as a base to describe the basic concepts present in any microcontroller system. This subject deals with several issues as connections, use of peripherals, timing, management and application of interrupts, and programming in assembly language in a microcontroller based system. The knowledge of all these fields is fundamental for the posterior subject called Sistemas Digitales II.

List of topics to be covered

1. The system microprocessor. Elements of a microprocessor system. Functional structure. Peripherals. The memory map. The microprocessor/microcontroller market.
2. Programming. Components of a program. Assembly language syntax and directives. The assembly process. Development and debugging. The instruction set. Examples.
3. Hardware Architecture. Block Diagram. MCF5272 Modules and terminals. The bus external. Transfer Modes. Configuration of the memory system.
4. Exceptions in the microprocessor system. Definition and types. Priority between exceptions. The exception processing. MCF5272 interrupt sources. Interrupt configuration. Management of consumption and the power management module.
5. Input / Output. Interfaces and peripheral input / output. Types of communication. Parallel communication. Serial communication. A simplified MCF5272 UART module.
6. Timing. Elements of a timer. Resolution and range. The input capture. The output compared. The timer module in the MCF5272. Pulse width modulation (PWM).
7. Memories in the microprocessor system. Memory types. Expanding word size and number of words. Dynamic Memory DRAM. The refresh process. DRAM controllers.

Prerequisites or co-requisites		
<ul style="list-style-type: none"> • Programming • Fundamentals of telematics systems • Digital Electronics 		
Course category in the program		
<input checked="" type="checkbox"/> R (required)	<input type="checkbox"/> E (elective)	<input type="checkbox"/> SE (selective elective)

Specific goals for the course	
Specific outcomes of instruction	
<p>RA1. Ability to analyze and design electronic circuits, both analog and digital.</p> <p>RA6. Understanding the structure of computers, microprocessors and microcontrollers and their programming languages, knowledge of Peripheral devices and input / output.</p> <p>RA7. Ability to design systems based on microprocessors.</p> <p>RA8. Knowledge of the mechanisms and timing management interrupts.</p> <p>RA9. Knowledge of implementation techniques, debugging and testing of systems based on microprocessors.</p> <p>RA10. Ability to integrate analog and subsystems digital microprocessor-based systems.</p>	
Student outcomes addressed by the course	
CG2, CG5, CECT1, CECT2, CECT3, CECT6, CECT9	

Bibliography and supplemental materials	
<ul style="list-style-type: none"> • C. Carreras, R. Córdoba, M.J. Ledesma, J.M. Montero, R. San Segundo, Diseño de sistemas digitales con el microcontrolador ColdFire 5272, 3ª edición, Dpto. de Ingeniería Electrónica, E.T.S.I. Telecomunicación, UPM, 2012 • A Clements, Microprocessor Systems Design. 68000 Hardware, Software and Interfacing, PWS-Kent Publishing. • Freescale ColdFire Family Programmer's Reference Manual, www.freescale.com • Freescale ColdFire 2/2M Version Processor Core User's Manual, www.freescale.com • Freescale ColdFire MCF5272 Integrated Microprocessor User's Manual, www.freescale.com • R. San Segundo et al., Introduction to Systems Digital MCF5272 microcontroller, Ed Marcombo. • Website of the subject http://moodle.upm.es/titulaciones/oficiales 	

Teaching methodology			
<input checked="" type="checkbox"/> lectures	<input checked="" type="checkbox"/> problem solving sessions	<input checked="" type="checkbox"/> collaborative actions	<input checked="" type="checkbox"/> laboratory sessions
Other:	Several exercises with complete digital systems are proposed and then they are evaluated with new questions in the class		