



# UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2023/2024
MASTER'S DEGREE (MSC)	ELECTRONICS AND TELECOMMUNICATIONS ENGINEERING (FULLY ONLINE)
SUBJECT	ELECTRONIC PROGRAMMABLE SYSTEMS
TYPE OF EDUCATIONAL ACTIVITY	B
AMBIT	50364-Ingegneria elettronica
CODE	20513
SCIENTIFIC SECTOR(S)	ING-INF/01
HEAD PROFESSOR(S)	GIACONIA GIUSEPPE      Professore Associato      Univ. di PALERMO COSTANTINO
OTHER PROFESSOR(S)	
CREDITS	9
INDIVIDUAL STUDY (Hrs)	162
COURSE ACTIVITY (Hrs)	63
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	1
TERM (SEMESTER)	2° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	<b>GIACONIA GIUSEPPE COSTANTINO</b> Tuesday 12:00 13:30 Dipartimento di Ingegneria Edif. 9 stanza U011 - Engineering Dept. Builg. 9 room U011 Wednesday 12:00 13:30 Dipartimento di Ingegneria Edif. 9 stanza U011 - Engineering Dept. Builg. 9 room U011

<b>PREREQUISITES</b>	Good understanding of the topics covered in the former first level Degree on Electronic Engineering and in particular strong knowledge of the contents of the courses "Digital Electronic Systems".
<b>LEARNING OUTCOMES</b>	<p>Knowledge and ability 'to understand The course tends to focus the study of the design methods for programmable electronic systems. Design methods and tools suitable for the development of complete applications, including a digital system as the central part of the solution are analyzed.</p> <p>Capacity 'to apply knowledge and understanding The student will mature a deep knowledge of the design criteria that lead to the design of a medium complexity digital system. He will also be able to interface this system with a scenario generally constituted by sensors, actuators, and logic interface connections with the chosen microprocessor and/or microcontroller.</p> <p>Making judgments The student will be able to independently design a medium complexity digital system, with deep insight into the functionalities starting from board layout containing the system and the firmware description loaded in the program memory of the designed system.</p> <p>Communication skills The student will acquire competences to discuss on the programmable electronic systems of the most modern electronics used in high technical and scientific contexts, strong practical knowledge of the circuit techniques and firmware solutions for the above systems.</p> <p>Learning ability All the knowledge gained during the course are primarily aimed at providing students with the essential tools to autonomously work and understand complex issues, normally carried out within a PhD program or that may be met in daily work.</p>
<b>ASSESSMENT METHODS</b>	<p>Lab assessment and oral examination, grading from 18 to 30 (out of 30). The student must primarily pass a laboratory assessment, usually at PC Lab of Polytechnic School, where in a predefined time interval (usually from 90 up to 150 minutes) he must use methods learned during the course and correctly solve a proposed design. This assessment must reach a minimum of 18 (out of 30) in order to get access to the oral examination, otherwise the student must repeat the lab assessment at later date.</p> <p>During the oral examination the student is asked to answer at least 3 questions chosen among the topics of the course syllabus. The exam is designed to test the acquired knowledge, the planning and solving ability, the presentation skills and the use of appropriate technical language of the student. The assessment is based on the following grades: a) excellent (30-30 cum laude): excellent knowledge of the topics, excellent use of technical language, good analytical ability, the student is able to apply knowledge to solve the proposed problems; b) very good (26-29): good knowledge of the topics, good use of technical language, the student is able to apply knowledge to solve the proposed problems; c) good (24- 25): basic knowledge of the main topics, discrete use of technical language, limited ability to independently apply the knowledge to the solution of the proposed problems; d) satisfactory (21-23): the student knows the main topics but has not a full grasp of them, satisfactory use of technical language, poor ability to independently apply the acquired knowledge; e) sufficient (18-20): minimal knowledge of the main topics and basic use of technical language, very little or no ability to independently apply the acquired knowledge; f) insufficient: the student does not have a minimum acceptable knowledge of the contents of the topics covered in the course.</p>
<b>EDUCATIONAL OBJECTIVES</b>	The course is focused on the study of design methods for programmable electronic systems. Design methods and tools for complete development of application having a digital system as a central part are mainly analyzed.
<b>TEACHING METHODS</b>	Lectures, Lab. exercises. Activities are organized in order to facilitate the achievement of the expected learning outcomes. In details, the contents of the course are offered through frontal lectures and guided lab exercises. The lectures are supplemented by

	<p>exercises during which the student can gradually apply the theoretical principles to the practical solutions, thus stimulating 'the development of the capacity' of application of knowledge and skills' acquired. All the activities of the course ultimately contribute to the development of learning skills, through the revision of the acquired knowledge.</p> <p>The course consists of a group of lectures, describing the main microprocessors and digital system found in modern electronic equipment. Basic methodologies for the analysis and design of embedded system are also treated. During the course numerical example and more generally worked design on practical design constraint are given.</p>
<b>SUGGESTED BIBLIOGRAPHY</b>	<p>Main references:</p> <ul style="list-style-type: none"> <li>• Notes, handouts and other useful articles or web link given by the instructor through the student portal</li> <li>• A.Clements: Principle of Computer Hardware Third Ed. - Oxford University Press. - ISBN 9780198564539</li> <li>• G.Baccolini C.Offelli: Microelaboratori, note di hardware. - Citta' Studi Edizioni. - ISBN: 8870055582 (freely available at <a href="http://www.microatena.it/scheda_libro.php?id=6">http://www.microatena.it/scheda_libro.php?id=6</a>)</li> </ul> <p>Other suggested references:</p> <ul style="list-style-type: none"> <li>• D. S. Dawoud and R. Peplow: Digital System Design - Use of Microcontroller, River Publishers Series - ISBN: 9788792329400 (freely available at <a href="https://www.riverpublishers.com/book_details.php?book_id=54">https://www.riverpublishers.com/book_details.php?book_id=54</a>)</li> <li>• K.C. Wang: Embedded and Real-Time Operating Systems - Springer ebook ISBN 978-3-319-51517-5 (e-book disponibile presso UniPa Discovery Service - <a href="https://link.springer.com/book/10.1007/978-3-319-51517-5">https://link.springer.com/book/10.1007/978-3-319-51517-5</a>)</li> </ul>

## SYLLABUS

<b>Hrs</b>	<b>Frontal teaching</b>
4	Introduction to programmable digital systems design. Analysis of systems requirements and preliminary design.
12	Digital Systems at a glance: Standard Logic, ASIC and Microprocessors. SPLD with recorded outputs and their expansion to CPLDs. Introduction to FPGAs and study of re-configurable elementary cells. Internal common logic and I/O block of a Xilinx FPGA. Introduction to Hardware Descriptions Language: VHDL and Verilog. Definition of Entities and Structural VHDL Description. VHDL structural descriptions by using a schematic approach. Top Level Concept and Hierarchical Design. VHDL Scheduling Event Simulation Model: Concurrent Programming. Synchronous and Asynchronous Sequential Logic in VHDL. Definition and VHDL encoding of Moore and Mealy type machines. Behavioral and physical synthesis. Analysis of critical paths in synthesizable structures.
6	Common interfaces and management of internal registers on parallel, serial programmable timer and DMA interfaces
9	Microprocessor systems with 16 and 32 bit class: general characteristic of Motorola 68K (CISC architecture) and introduction to soft IP core (ARM7TDMI). Programming models, interrupts managements, instructions set and related address modes.
<b>Hrs</b>	<b>Practice</b>
32	Activities carried out on students' personal computer and with installed Software (free licence) suggested by teacher. They are based on mastering digital design methodologies using the VHDL hardware description language