ADVANCED EMBEDDED SYSTEMS (MSC)

COURSE OUTLINE

Responsible: Miltiadis Grammatikakis

1. GENERAL			
SCHOOL	School of Engineering		
ACADEMIC UNIT	MSc in Informatics Engineering		
LEVEL OF STUDIES	Postgraduate		
COURSE CODE	МП1007	**SEMESTER**	2nd
COURSE TITLE	Advanced Embedded Systems		

INDEPENDENT TEACHING ACTIVITIES if credits are awarded for separate components of the course	**WEEKLY TEACHING HOURS**	**CREDITS**
	0	7.5
	3	7.5
Total	**3**	**15**

COURSE TYPE general background, special background, specialised general knowledge, skills development	Specialization
PREREQUISITE COURSES	None
LANGUAGE OF INSTRUCTION and EXAMINATIONS	English
OFFERED TO ERASMUS STUDENTS	Yes (in English) — Spring Semester
COURSE WEBSITE (URL)	https://eclass.hmu.gr/courses/TP264

2. LEARNING OUTCOMES

Learning outcomes

Upon successful course completion, the students will be able to:

- identify problems that can be solved using low-cost embedded systems, or real-time embedded systems,
- understand the design flow and the use of EDA tools for implementing systems-on-chip (develop, FPGA),
- design, implement and optimize embedded systems related to key application domains (e.g., transportation, E-health).

General Competences

The course aims towards improving the following student abilities,

- understanding the foundations of complex system design, development, and analysis,
- mastering new technology challenges,
- doing individual work,
- doing teamwork,
- criticize and/or self-criticize,
- perform reasonable R&D related to system engineering.

3. SYLLABUS

Unit 1: Embedded Systems: Design Languages and Methodologies - Examples

- System-on-chip Modeling, design flow, abstraction levels
- Top-down (platform-based), and bottom-up (component-based) design
- System-level design, High-level synthesis, Model-driven design engineering, π.χ. μέσω UML
- Intellectual Property cores and related standardization

Unit 2: RTL Design: Languages and Methodologies - Examples

- IP Modeling using HDLs (Verilog and VHDL)
- Reconfigurable technology and rapid prototyping
- EDA tools for ISA (ISS, caching)
- Clocks, Critical Paths, Time closure
- Co-design, co-simulation, co-validation, verification
- RTL synthesis from system-level design using SystemC/C/C++ libraries.

Unit 3: Electronics System-Level Design

- System-level modeling and simulation (processor, routers, network-on-chip or bus, memory interfaces, peripherals)
- Transaction-Level Modeling (TLM)
- Analog-Mixed Signal Modeling
- Sequential and parallel simulation (simulation kernels, event lists)
- System-level power estimation: tools and methodologies
- RTOS Modeling
- Stochastic approaches to system-level optimization, e.g., simulated annealing
- SystemC modeling & simulation

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY Face-to-face, Distance learning, etc.	Lectures & Optional Exercises
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY Use of ICT in teaching, laboratory education, communication with students	Use of ICTs in • lecturing and lab • for the communication with students via the e-class platform
TEACHING METHODS The manner and methods of teaching are described in detail.	
STUDENT PERFORMANCE EVALUATION Description of the evaluation procedure	Project that relates to the design, implementation, and analysis of an embedded system (100%). The methods and criteria for evaluation are explained in eclass and involve slide presentation and demo.

Activity	**Semester workload**
Lectures and Lab Demonstrations	65
Independent Student Projects	155
Final Oral Presentation and Demonstration	5
Course total	**225**

5. ATTACHED BIBLIOGRAPHY

Open-source software & tools (Manuals, papers).

Sample Books

- Peter Marwedel, ``Embedded System Design', Kluwer Academic Publisher, 2003.
- W. Wolf, ``Computers as Components: Principles of Embedded Computing Systems Design', Morgan Kaufman Publisher, 2001, ISBN 1-55860-541- X (case), ISBN 1-55860-693-9.
- Qing Li and Carolyn Yao, “Real-Time Concepts for Embedded Systems”, ISBN:1578201241.

Relevant Scientific Literature

From international conferences, e.g., DAC and DATE or journals, e.g., IEEE IoT Journal, IEEE Transactions on Computers, ACM Transactions on Embedded Computing Systems