COURSE OUTLINE

(1) GENERAL

SCHOOL	Engineering		
DEPARTMENT	Electrical and Computer Engineering		
LEVEL OF STUDY	Undergraduate		
COURSE UNIT CODE	9.012	**SEMESTER OF STUDY**	9th
COURSE TITLE	Embedded Systems		
COURSEWORK BREAKDOWN		**TEACHING WEEKLY HOURS**	**ECTS Credits**
Theory (Lectures)		3	2
Tutorial/Project		1	1
Laboratory		1	1
TOTAL		**5**	**4**
COURSE UNIT TYPE	Specialized knowledge/Skills development		
PREREQUISITES	Computer Organization, Programming		
LANGUAGE OF INSTRUCTION/EXAMS	Greek		
COURSE DELIVERED TO ERASMUS STUDENTS	Yes		
WEB PAGE (URL)	https://eclass.hmu.gr/courses/		

(2) LEARNING OUTCOMES

Learning Outcomes

Embedded Systems focuses on developing methodologies for application-specific computing systems. After completing this course, students should be able to:

- Understand of use-cases, particular per application and per system requirements of a real-time or embedded system
- Understand methods to solve scenarios encompassing real-time attributes
- Understand and acquire experience in developing suites and toolchains in programming embedded devices
- Utilize operating systems and real-time operating systems in specialized embedded systems
- Understand and analyze embedded systems applications performance
- Utilize modern methods and tools together with reconfigurable systems to develop embedded systems

General Skills

The objective of this course is for the student to acquire the following general skills:

- Quest, analysis, and composition of data and information through using the needed technologies
- Adapting to new situations
- Autonomous studying and collaborative studying
- Creative judgement, critical thinking
- Decision making
- Development of innovative research ideas

(3) SYLLABUS

This course focuses in providing a foundation in designing and developing embedded systems through using modern techniques and methods for systems-on-chip(SoCs). Additionally, it focuses on familiarizing with modern CAD tools to implement specialized hardware and software embedded systems.
The course comprises of lectures and laboratory exercises focusing on:
Develop a modern embedded system-on-chip for IoT and specific cyber-physical systems
Design an embedded system based on ARM microprocessor, or other microcontrollers such as MicroBlaze or M4
Develop software applications targeting these microcontrollers in IoT environments and various use-cases.

In particular, this course involves:
Introduction to embedded systems and definition of terms such as modeling and environment of real-time systems
Architectures and development methods for embedded systems, microcontrollers, and particular requirements regarding development environments, cross-compilers assemblers and emulators.
Design flows in developing and modeling in C, Java, etc
Real-time concepts, clocks, timers, events, responses, interrupts, etc
Real-time operating systems (RTOS), realizing and optimizing RTOS-based systems
Systems-on-chip design challenges and realizing technologies
Hardware-software co-design, fault-tolerance and modern concepts

The laboratory focuses on design and prototyping of embedded, systems-on-chip, analysis and assessment of quantitative performance through using simulators and modern embedded development platforms.

(4) TEACHING METHODS - ASSESSMENT

<table>
<tr><td>MODE OF DELIVERY</td><td>In-Class Face-to-Face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATION TECHNOLOGY</td><td>• Use of ICTs in lecturing and lab
• Use of ICTs for the communication with students via the e-class platform</td></tr>
<tr><td>TEACHING ORGANISATION</td><td>
<table>
<tr><th>Method description / Activity</th><th>Semester Workload</th></tr>
<tr><td>Lectures</td><td>35</td></tr>
<tr><td>Exercises</td><td>15</td></tr>
<tr><td>Labs</td><td>20</td></tr>
<tr><td>Individual Projects</td><td>20</td></tr>
<tr><td>Individual Study</td><td>30</td></tr>
<tr><td>Total Contact Hours</td><td>120</td></tr>
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<tr><td>ASSESSMENT METHODS</td><td>Language for Evaluation: Greek/English (Erasmus)

All announcements related to the syllabus, including grading, assessment criteria, and complementary reading material are permanently posted in the course web page (e-</td></tr>
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	class). The course grade is based on the following evaluation procedures: 1. Final exam on theoretical/practical problems (60%). The objective is to assess the students' understanding of key theoretical and practical concepts. 2. Individual take-home exercises/projects (15%) 3. Lab programming exercises (25%)

(5) RECOMMENDED BIBLIOGRAPHY

- *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*
- *George Kornaros, "Multi-core embedded systems", CRC Press, Apr. 2010*

Related Scientific Publications
Selected articles published in top conferences such as IEEE/ACM CASES, CODES, EMSOFT, CPSCOM, and journals (such as όπως IEEE IoT Journal, IEEE Transactions on Computers, ACM Transactions on Architecture and Code Optimization, ACM Transactions on Embedded Computing Systems, ACM Transactions on Internet of Things)