COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF ELECTRONICS ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	2607004	**SEMESTER**	7
COURSE TITLE	Microcontrollers - Embedded Systems		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS (ECTS)**
Lectures	3	6
Laboratory	2	
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialisation Course
PREREQUISITE COURSES:	None
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES (in English)
COURSE WEBSITE (URL)	http://www.electronics.teipir.gr/personalpages/papageorgas/download/mcu_embedded/

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Upon successful completion of this course module students possess advanced knowledge, skills and competences in the subject of Microcontrollers and Embedded Systems that enable them to:

1. Demonstrate knowledge and understanding of the fundamental principles embedded systems design, explain the process and apply it.
2. Demonstrate knowledge and understanding of the microcontroller technology both for hardware and software.
3. Design embedded systems based on microcontrollers.
4. Demonstrate knowledge and understanding of Hardware/Software co-design techniques for microcontroller-based embedded systems, apply techniques in design problems.
5. Program microcontrollers in C using Integrated Development Environments and using

debugging techniques.

6. Know and classify microcontrollers' peripherals; know, understand and explain low-power technology and Interrupt mechanisms.
7. Design and implement a complete embedded system as a project.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology	*Project planning and management*
Adapting to new situations	*Respect for difference and multiculturalism*
Decision-making	*Respect for the natural environment*
Working independently	*Showing social, professional and ethical responsibility and sensitivity to gender issues*
Team work	*Criticism and self-criticism*
Working in an international environment	*Production of free, creative and inductive thinking*
Working in an interdisciplinary environment	*……*
Production of new research ideas	*Others…*
	…….

- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Working independently
- Team work
- Production of free, creative and inductive thinking

(3) COURSE CONTENT

Lectures

1. Introduction to Embedded Systems
2. Microcontroller architectures
3. MSP430 Instruction set, Addressing modes
4. Interrupt signals and routines
5. Interface circuits
6. Analog and Digital Peripherals programming: Digital I/Os, Timers, ADC and Communication Peripherals, Low power modes of operation

Laboratory Experiments

Programming of embedded systems in C using Integrated Development Environment. Programming of MSP430 microcontrollers. Development of Microcontroller Applications in practice.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to face lectures
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Use of electronic presentation with multimedia content and interactive whiteboard in class, • Student support through the course webpage and the departmental e-learning platform, as well as by videos of lectures, • Electronic communication of instructors and students, through the course webpage and by e-mail.

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Use of applications development software for microcontrollers in the lab.
Use of a microcontroller programming and debugging software tool in the lab.

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<tr><td>TEACHING METHODS
The manner and methods of teaching are described in detail.
Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.

The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</td><td>Lectures, Laboratory experiments, projects, study.

<table>
<tr><th>Activity</th><th>Semester workload (hours)</th></tr>
<tr><td>Lectures</td><td>39</td></tr>
<tr><td>Study for lectures</td><td>39</td></tr>
<tr><td>Laboratory experiments</td><td>26</td></tr>
<tr><td>Report on lab experiments</td><td>26</td></tr>
<tr><td>Individual or group projects</td><td>26</td></tr>
<tr><td>Study and preparation for exams</td><td>24</td></tr>
<tr><td>Course Total</td><td>180</td></tr>
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<tr><td>STUDENT PERFORMANCE EVALUATION
Description of the evaluation procedure

Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other

Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</td><td>Final grade = Theory part grade x 60% + Lab part grade x 40%

Theory Part grade:

Final written exam (80%),
Written project (optional) (20%)

or

Final written exam (100%)

Lab part grade:

Tests /presence (10%),
Written project reports (60%),
Written final exam (30%)

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</table>

(5) ATTACHED BIBLIOGRAPHY

Essential reading

1. J. H. DAVIES, MSP430 Microcontroller Basics, NEWNES-ELSEVIER, ISBN: 978-0-7506-8276-3
2. D. V. GADRE, Programming and Customizing the AVR Microcontroller
3. TEXAS Instruments, MSP430Family Data sheets.
4. TEXAS Instruments, MSP430Family Instruction Set Manual.