COURSE OUTLINE

(1) GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	ELECTRICAL AND COMPUTER ENGINEERING DEPT.		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**ECE_ELE960**	**SEMESTER**	**9**
COURSE TITLE	ADVANCED MICROCOMPUTER 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**
Lectures	3	
Seminars / Practice exercises	0	
Laboratory	1	
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (4).	4	5

COURSE TYPE *general background, special background, specialised, general knowledge, skills development*	Specialized
PREREQUISITE COURSES:	ECE_K140 Digital Logic Design ECE_K410 Computer Architecture ECE_K620 Microcomputer Systems
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	
COURSE WEBSITE (URL)	https://www.ece.uop.gr/

(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*

This course aims at the in-depth understanding of the modern CISC microprocessors architecture, their functionality as well as their interconnection with memory and peripheral I/O chips. Emphasis is given on the analysis of the characteristics of the Intel family of microprocessors, such as addressing modes, data movement, arithmetic/logical and flow control instructions, memory and I/O interface, interrupts, direct memory access, arithmetic coprocessor, fixed- and floating-point arithmetic, address, data and control bus interface. The course addresses all versions of the Intel family of microprocessors, which include 8086 up to the modern multi-core microprocessors.

At the end of this course the students should:

<u>At the knowledge level:</u>

1. Know the programming of Intel family of microprocessors.
2. Know the addressing modes.
3. Know the differences concerning the operation at the real and protected mode.
4. Know the memory interfaces and the interconnection with programmable peripheral chips (82C55, 8279, 8254, 16550, ADC0804, DAC0830, 8259A, 8237).
5. Know the interrupt mechanism.
6. Know the Direct Memory Access (DMA) mechanism.
7. Know the fixed- and floating-point arithmetic.
8. Know the differences between the CISC and RISC architectures.

At the skill level - abilities:

1. Develop software programs in x86 assembly language.
2. Perform calculations both in fixed- and floating-point arithmetic.
3. Design microcomputer systems connected with memory and peripheral I/O devices for developing complex hardware and software systems.

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, analysis and synthesis of data and information, with the use of the necessary technology.
- Working independently.
- Teamwork (at the laboratory).
- Working in an international environment.
- Production of free, creative and inductive thinking.

(3) SYLLABUS

The course consists of the following sections:

1. **Basic principles:** History of computer systems, hardware and software, arithmetic systems, structure, organization and operation of computers, central processing unit, memory system, memory address decoding, types of machine-language instructions, instruction set architecture, complex and reduced instruction set computers.
2. **Microprocessor architecture:** Control unit, arithmetic/logic unit, multi-purpose registers, programming model, real and protected mode.
3. **Addressing modes:** Register, immediate, direct, register indirect, base-plus-index, register relative, base relative-plus-index, scaled index.
4. **Instructions:** Data movement, arithmetic/logic and program control instructions.
5. **Programming the microprocessor:** Modular programming, macros, modules, routines and DOS functions.
6. **Pin-out and pin functions:** Pin connections, I/O characteristics, address and data bus demultiplexing, bus buffering, bus timing, 8288 bus controller.

7. **Memory interface:** Memory types, address, data and control connections, ROM, SRAM, DRAM , address decoding.
8. **I/O interconnection:** Isolated and memory-mapped I/O, I/O instructions, I/O port address decoding, 82C55 programmable peripheral interface, 8279 programmable keyboard/display interface, 8254 programmable interval timer, 16550 programmable communication interface, A/D ADC0804, D/A DAC0830, , 8259A programmable interrupt controller, 8237 DMA controller.
9. **Hardware and software applications.**

Laboratory exercises

1. Introduction to MASM.
2. Data movement and arithmetic instructions.
3. Logical, loop, compare and branch instructions.
4. Delay routines and access to VGA text memory.
5. Array processing, lookup tables, macros and routines.
6. Speed and direction control of a stepper motor.
7. Temperature control.
8. LED control with photodiode.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	• Face-to-face in the class and in the laboratory. • Distance learning through the e-Class platform.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• PowerPoint presentations of the course lectures, which have been uploaded to the e-Class page of the course. • Laboratory guide, at the e-Class page of the course. • Support of educational procedure through the e-Class platform for discussion and solving of relevant problems. • Microsoft Macro Assembler 8.0 (MASM) Package (x86): Assembly 80x86 Simulator for the laboratory exercises, installed per student PC.
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*	
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure*	(a) Final written exam of the theoretical part of the course. (b) Laboratory grade which consists of: - laboratory report grade (40%) - final laboratory exam (60%)

Activity	***Semester workload***
Lectures	39
Laboratory exercises	13
Preparation for the laboratory exercises	13
Personal study	60
Course Total	***125 hours (5 ECTS)***

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.*	The laboratory exercises are mandatory. The final grade of the course is derived as follows: Grade = (a)*60% +(b)*40% Evaluation language: Greek

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

1. B. B. Brey, The INTEL Microprocessors, Architecture, Programming and Interfacing, eighth edition, 2009.
2. Κ. Πεκμεστζή, Συστήματα μικροϋπολογιστών Ι: Μικροεπεξεργαστές 80x86, Pentium και ARM, Εκδόσεις Συμμετρία, 2009.
3. Γ. Φ. Αλεξίου, Μικροεπεξεργαστές και σχεδιασμός μικροϋπολογιστικών συστημάτων, Εκδόσεις Κλειδάριθμος, 2012.
4. Δ. Πογαρίδη, Σχεδίαση συστημάτων μικροεπεξεργαστών, Εκδόσεις Β. Γκιούρδα, 2006.
5. The Art of Assembly Language, URL: https://www.ic.unicamp.br/~pannain/mc404/aulas/pdfs/Art%20Of%20Intel%20x86%20Assembly.pdf
6. K. Bhurchandi, A. Ray, Advanced Microprocessors and Peripherals, third edition, Tata McGraw Hill, 2013.
7. Intel 64 and IA -32 Architectures Software Developer's Manual, 2006.