COURSE OUTLINE

(1) GENERAL

SCHOOL	Engineering		
DEPARTMENT	Electrical and Computer Engineering		
LEVEL OF STUDY	Undergraduate		
COURSE UNIT CODE	4.003	**SEMESTER OF STUDY**	4th
COURSE TITLE	Computer Organization		

COURSEWORK BREAKDOWN	**TEACHING WEEKLY HOURS**	**ECTS Credits**
Theory (Lectures)	4	4
Laboratory	1	1
TOTAL	**5**	**5**

COURSE UNIT TYPE	Specialized general knowledge/Skills development
PREREQUISITES	Logic Design
LANGUAGE OF INSTRUCTION/EXAMS	Greek
COURSE DELIVERED TO ERASMUS STUDENTS	Yes
WEB PAGE (URL)	https://eclass.hmu.gr/courses/TP284/

(2) LEARNING OUTCOMES

Learning Outcomes

Computer Organization focuses on foundations of microprocessors internal organization along with the connected computational units and in particular on study of the functionality of the microprocessor and of the memory hierarchy sub-system. The objective of this course is to provide students with strong background on computer organization fundamentals. After completing this course, students should be able to:

- Recognize and grasp the internal organization of a computer, CPU, memory and I/O units, while understanding the relation between digital logic design and application interfacing
- Understand the internal structure of computational elements in a modern system
- Understand functioning of the CPU at instruction level and relation with higher-level programming concept
- Recognize the basics of, and develop the ability to determine the applicability of single-cycle (MIPS), multi-cycle (MIPS), parallel, pipelined, superscalar, and RISC/CISC architectures
- Analyse cost performance and design trade-offs in designing and constructing a computer processor including memory
- Perform elementary quantitative performance evaluation of computer systems
- Solve elementary problems by assembly language programming

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

The objective of this course is to study the foundations of the design and analysis of the structure and function of modern computing systems, with a focus on central processing unit and its associated memory hierarchy sub-system. The goal is to give the student an understanding of the instruction-set architecture along with the design of the corresponding data-path with pipelining and the basic concepts of the memory hierarchy.

Introduction to modern technologies of implementing computing systems- MIPS Instruction Set Architecture (ISA), Fundamental Concepts and ISA, ISA Tradeoffs - Computer Arithmetic - Representation of Floating Point Values and Floating Point Arithmetic - Datapath Design - Single-Cycle Microarchitectures - Control Path Design - Pipelined Datapath and Control - Data Hazards and Forwarding - Control Hazards and Prediction- Memory hierarchy and Cache Memories

The laboratory focus is placed on programming in MIPS assembly language and basic quantitative performance evaluation of developed code

(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>50</td></tr>
<tr><td>Exercises</td><td>20</td></tr>
<tr><td>Labs</td><td>20</td></tr>
<tr><td>Individual Programming</td><td>20</td></tr>
<tr><td>Individual Study</td><td>40</td></tr>
<tr><td>Total Contact Hours</td><td>150</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-class). The course grade is based on the following evaluation procedures:
1. Final exam on theoretical/practical problems (40%). The objective is to assess the students' understanding of key theoretical and practical concepts.
2. Intermediate exams (25%)
3. Individual take-home exercises/projects (15%)
4. Lab programming exercises (20%)</td></tr>
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(5) RECOMMENDED BIBLIOGRAPHY

- *Textbook: Computer Organization and Design: The Hardware/ Software Interface, Fifth Edition, 2014, by John L. Hennessy and David A. Patterson*
- *Οργάνωση και Αρχιτεκτονική Υπολογιστών, 10η Έκδοση/2016, by Stallings William, ISBN: 978-960-418-580-1, Εκδότης): ΕΚΔΟΣΕΙΣ Α. ΤΖΙΟΛΑ & ΥΙΟΙ Α.Ε.*

Related Scientific Publications
IEEE Transactions on Computers, IEEE Transactions on Parallel and Distributed Systems, IEEE Transactions on Computer Aided Design of Integrated Circuits and Systems, IEEE Micro, ACM Transactions on Architecture and Code Optimization, ACM Transactions on Design Automation of Electronic Systems