# COURSE OUTLINE

## (1) GENERAL

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|---|---|---|---|
| **SCHOOL** | Engineering | | |
| **ACADEMIC UNIT** | Department of Computer Engineering & Informatics | | |
| **LEVEL OF STUDIES** | Undergraduate | | |
| **COURSE CODE** | CEID_NY261 | **SEMESTER** | 3nd |
| **COURSE TITLE** | Basic topics in Computer Architecture | | |

| **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 and tutorials | 4 | 4 |
| *Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).* | ***Total*** | **6** |

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|---|---|
| **COURSE TYPE** *general background, special background, specialised general knowledge, skills development* | Specialized general knowledge<br>Skills development |
| **PREREQUISITE COURSES:** | Introduction to Computers and Programming (NY131)<br>Digital Design I (NY163)<br>Digital Design II (NY164) |
| **LANGUAGE OF INSTRUCTION and EXAMINATIONS:** | Greek |
| **IS THE COURSE OFFERED TO ERASMUS STUDENTS** | No |
| **COURSE WEBSITE (URL)** | https://eclass.upatras.gr/courses/CEID1009/<br>https://eclass.upatras.gr/courses/CEID1036/ |

**(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*

**A. Lectures and Tutorials**

Upon successful completion of the course, a student will:

(1) be able to understand the differences among structure, organization, implementation and architecture
(2) describe the units that constitute a computer and their operation
(3) know the parameters affecting the performance of a computer system
(4) select the correct way for data representation in a computer
(5) be able to avoid problems stemming from the processing of arithmetic data
(6) be able to classify processors according to their instruction set
(7) be able to use the correct addressing modes
(8) know the technologies used for the implementation of the memory system and their characteristics
(9) be able to design a main memory system satisfying given specifications
(10) be able to describe the input-output process
(11) know the differences of polling, interrupts and direct memory access based input-output

**B. Laboratory**

Upon successful completion of the course, a student will be able to :

(1) write assembly language programs for an ARM processor
(2) debug assembly language programs
(3) given the programming model and the instruction set of a processor to write programs at its assembly language

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, Project planning and management*

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

Decision-making
Adapting to new situations
Working independently
Team work
Working in an international environment
Production of new research ideas

## (3) Syllabus

**A. Lectures and Tutorials**

- Introduction: Hardware, software, Computer architecture, Computer structure and organization, input and output units, Computer performance.
- Information representation:
  - ✓ Data
    - constant point arithmetic
    - floating point arithmetic
    - alphanumeric
    - image
    - sound
  - ✓ instructions
    - machine instruction types
    - addressing modes
    - operands size and type
    - machine instructions encoding
    - machine instructions based computer classification
- Central processing unit:
  - ✓ data path
    - ALU
    - register file
    - shifter
    - divider
    - multipier
  - ✓ floating point unit
  - ✓ control unit (structure and implementation)
- Memory system:
  - ✓ memory technology
    - semiconductor
    - magnetic
    - optical memories
  - ✓ memories hierarchy
  - ✓ main memory implementation.
- Interconnection and input-output system:
  - ✓ bus
  - ✓ bus types
  - ✓ synchronous and asynchronous busses
  - ✓ bus arbitration
- input-output process
  - ✓ polling
  - ✓ interrupts
  - ✓ direct memory access

**B. Laboratory**

- ARM programming model
- Instruction set of ARM
- Programming at assembly language level
- Program debugging

## (4)TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY<br>Face-to-face, Distance learning, etc.</td><td>Face-to-face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY<br>Use of ICT in teaching, laboratory education, communication with students</td><td>Wide use of ICT and more specifically :<br>· The course is backed up by a web page for the lectures and the tutorials and a second e-class page providing all necessary documentation for the laboratory exercises.<br>· The preferred communication method with the students is email.</td></tr>
<tr><td>TEACHING METHODS<br>The manner and methods of teaching are described in detail.<br>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.<br>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>
<table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<tr><td>Lectures</td><td>26 hours</td></tr>
<tr><td>Tutorials</td><td>26 hours</td></tr>
<tr><td>Laboratory exercises</td><td>26 hours</td></tr>
<tr><td>Laboratory exercises preparation</td><td>32 hours</td></tr>
<tr><td>Report preparation</td><td>13 hours</td></tr>
<tr><td>Study</td><td>53 hours</td></tr>
<tr><td>Theory exams</td><td>3 hours</td></tr>
<tr><td>Laboratory exams</td><td>1 hour</td></tr>
<tr><td>Course total</td><td>180 hours</td></tr>
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</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION<br>Description of the evaluation procedure<br><br>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<br><br>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</td><td>The evaluation is performed in Greek language and is based on two independent parts.<br><br>The theory evaluation is performed through a final written test that includes multiple choice questions, short-answer questions and problem solving. After the test marks are announced the students have the opportunity to see their mistakes.<br><br>The evaluation for the laboratory part is based :<br>· on the correctness of the programs developed by the students during their lab exercise,<br>· on the quality of documenting the programs that they try to develop via their reports and<br>· on a final practical exam in which they are asked to develop in the lab a small program and execute it.</td></tr>
</table>

**(5) ATTACHED BIBLIOGRAPHY**

- *Suggested bibliography:*
  - Computer Architecture, Dimitrios Nikolos, 1st edition 2017, in Greek
  - Computer Organization and Design: The Hardware/software Interface, Vol.1, 2010, D. A. Patterson, J. L. Hennessy, in Greek
- *Related academic journals:*
  - IEEE Micro
  - IEEE Transactions on Computers
  - IEEE Transactions on VLSI Systems
  - IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems