MODULE OUTLINE

1. GENERAL INFORMATION

SCHOOL	SCHOOL OF SCIENCE AND TECHNOLOGY		
PROGRAM COURSE	INFORMATICS		
LEVEL OF STUDY	UNDERGRADUATE		
MODULE CODE	PLI-21	**YEAR OF STUDY**	2nd
MODULE TITLE	Digital Systems		
INDEPENDENT TEACHING ACTIVITIES *in case credits are awarded for separate components/parts of the course, e.g. in lectures, laboratory exercises, etc. If credits are awarded for the entire course, give the weekly teaching hours and the total credits*		**HOURS**	**CREDIS**
Weekly teaching hours * 32 weeks		14-16	18 ECTS
COURSE TYPE *Background knowledge, Scientific expertise, General Knowledge, Skills Development*	Scientific expertise Compulsory		
PREREQUISITE MODULES:	No		
LANGUAGE OF INSTRUCTION AND EXAMS	GREEK		
THE MODULE IS OFFERED TO ERASMUS STUDENTS	No (due to annual duration of the module)		
MODULE WEBSITE (URL)	https://www.eap.gr/education/undergraduate/computer-science/topics/#psifiaka_sistimata Each module has its own space in the Learning Management System of EAP (http://study.eap.gr), with controlled access (use of code) for students and teaching staff.		

2. LEARNING OUTCOMES

Learning Outcomes

- *The course learning outcomes, specific knowledge, skills and competences of an appropriate (certain) level, which students will acquire upon successful completion of the course, are described in detail. It is necessary to consult:*

VOLUME 1: DIGITAL DESIGN

On successful completion of the study of the first volume, students will know:

- The difference between analog and digital signals.
- The advantages of digital against analog systems
- Binary representation of numbers (BCD, sign magnitude, 1's complement, 2' s complement) and the arithmetic operations between them

- The fundamentals of error detecting and correcting codes and as examples parity based codes Hamming code.
- To differentiate between combinational and sequential circuits.
- Boolean algebra.
- Various ways to specify logic functions (truth table, logic expression) and simplify them (e.g. using theorems of Boolean algebra, using Karnaugh map).
- Correspondence of simple logic functions to logic gates and the schematic representation of logic functions with logic gates (logic circuits).
- The functionality and the design of complex logic functions which are common in digital systems (comparators, adders, decoders, multiplexers).
- To design large combinational units using as building blocks less complex logical circuits.
- Several elementary sequential circuits (flip-flops) and their function.
- To analyze sequential circuits.
- To design sequential circuits.
- To design registers of different functionality (parallel input, shift register, multifunctional register)

VOLUME 2: COMPUTER ARCITECTURE

On successful completion of the study of the second volume, students will know:

- The components of a computer system and their operation.
- The meaning of architecture, structure, organization and implementation of a computer system.
- Methods of performance evaluation.
- The representation of information.
- The encoding of machine language instructions and the memory addressing modes.
- Central Processing Unit subunits (register file, shifters, arithmetic/logic unit, multiplier, divider) structure, organization and function.
- Memory units which are used for the implementation of the memory system and their features.
- Memory hierarchy.
- Cache memory (fetch policies, organization, placement and replacement policies and policies for updating higher levels of the memory hierarchy).
- Main memory organization and features (size, word length, bandwidth).
- Busses and their classification (dedicated, shared, CPU-memory busses, system busses, input/output busses, synchronous and asynchronous busses).
- Arbitration and arbitration types
- Input/output organization (programmed Input/Output, interrupts, direct memory access)

VOLUME 3: MICROPROCESSORS

On successful completion of the study of the third volume, students will know:

- The meaning of microprocessor, microcomputer and microcontroller.
- The evolution of the microprocessors.
- Features of several commercial microprocessors.
- Interfacing peripherals and main memory to microprocessors.
- Programming in assembly language (Intel,8085)

General Competences

Taking into consideration the general competences that students/graduates must acquire (as those are described in the Diploma Supplement and are mentioned below), at which of the following does the course attendance aim?

Search for, analysis and synthesis of data and information by the use of appropriate technologies,
Adapting to new situations
Decision-making
Individual/Independent work
Group/Team work
Working in an international environment
Working in an interdisciplinary environment
Introduction of innovative research
Project planning and management
Respect for diversity and multiculturalism
Environmental awareness
Social, professional and ethical responsibility and sensitivity to gender issues
Critical thinking
Development of free, creative and inductive thinking
……
(Other…….citizenship, spiritual freedom, social awareness, altruism etc.) …….

Search for, analysis and synthesis of data and information by the use of appropriate technologies,
Adapting to new situations
Decision-making
Individual/Independent work
Working in an interdisciplinary environment
Project planning and management
Critical thinking
Development of free, creative and inductive thinking

3. MODULE CONTENT

The aim of this module is to introduce students to the hardware of computing systems. Specifically, starting from basic concepts of digital logic and logic circuits, the students study the fundamental building blocks of digital systems. They learn how to analyze and design combinational and sequential circuits. These circuits are the basic building elements of any computational system, the architecture of which is subsequently studied. The subjects that follow are the structure of the Central Processing Unit, the memory and that various ways of performing data Input/Output. Finally, the module deals with microprocessors, the structure and operation of two basic microprocessor families (Intel & Motorola) and the programming at the Assembly language level.

The key subjects of the Module are:
1. Digital Design I
2. Computer Architecture I
3. Microprocessors

4. TEACHING METHODS--ASSESSMENT

MODES OF DELIVERY *Face-to-face, in-class lecturing,*	Distance education with five Group Counseling Meetings (OSS) during the academic year on

<table>
<tr><td>distance teaching and distance learning etc.</td><td>weekends.</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATION TECHNOLOGY
Use of ICT in teaching, Laboratory Education, Communication with students</td><td>We use :
Remote meetings tools (skype for business),
Presentation software (e.g. power point),
Specialized software in the subjects under study (Intel 8085 simulators, Logic Diagram Drawing Tools, etc.).

Additionally, the students use office automation tools, web browsers and e-reader for digital books.</td></tr>
<tr><td>MODULE DESIGN
Description of teaching techniques, practices and methods: Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, Internship, Art Workshop, Interactive teaching, Educational visits, projects, Essay writing, Artistic creativity, etc

The study hours for each learning activity as well as the hours of selfdirected study are given following the principles of the ECTS.</td><td>
<table>
<tr><th>Activity</th><th>Annual Workload</th></tr>
<tr><td>5 OSS (* 4 hours)</td><td>20</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Preparation of Assignments (4 assignments * 40 hours)</td><td>160</td></tr>
<tr><td>Examination</td><td>5</td></tr>
<tr><td>Individual study</td><td>263-327</td></tr>
<tr><td>Total module workload (hours)</td><td>448-512</td></tr>
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</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION/ASSESSMENT METHODS
Detailed description of the evaluation procedures.

Language of evaluation, assessment methods, formative or summative (conclusive), multiple choice tests, short- answer questions, open-ended questions, problem solving, written work, essay/report, oral exam, presentation, laboratory work, other……etc.

Specifically defined evaluation criteria are stated, as well as if and where they are accessible by</td><td>Elaboration of written assignments during the academic year, the average of the grades of which participates in the formation of the final grade of module by 30%, if there is a passable in the final or repetitive examinations. In the final written exams the grade of the written assignments participates in the formation of the final grade of module by 70%.

All the criteria are posted, both in each written assignment (in the LMS study.eap.gr), as well as in the general regulation of HOU at:
https://www.eap.gr/education/study-regulations/

The PLI21 module includes a midterm exam that is administered as follows:
· The midterm exam follows the completion of the subjects of Digital Design I and II and the submission and grading of the second written assignment.
· Taking the exam is optional, but students must sign</td></tr>
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the students	in advance for participation in it. · Each student taking the midterm exam will be asked to accept or reject his/her grade before the final exam. · In case the student accepts his/her midterm exam grade (provided, of course, that he/she has achieved a grade of at least 50%), this grade counts for 35% of the grade of the final exam. Moreover, the student will not be reexamined on the subject of Digital Design I&II. · In case the student rejects the midterm exam grade, he/she will be examined on the complete subject matter of the module at the final exams. · The duration of the final exam will be reduced by 35% for those students that have accepted the grade of the midterm exam. · Students are expected the sign in for the midterm exam by 31/12 each year.

(6) SUGGESTED BIBLIOGRAPHY

- *Suggested bibliography:*

HOU Publications:
Volume 1/1st Part: Digital Design I, HOU, Patras 2008. PLI21/1/A/08
Volume 2/2nd Part: Digital Design II, HOU, Patras 2008. PLI21/1/B/08
Volume 3: Computer Architecture I, HOU, Patras 2008. PLI21/2/09
Volume 4: Microprocessors, HOU, Patras 2008. PLI21/3/09

External Publications:
M. Roumeliotis, S. Souravlas, Digital Design: Principles and Applications, 2nd edition, Tziola Publ. 2018.

-Related scientific Journals:

1) IEEE Computer Architecture Letters
2) IEEE Transactions on Computers
3) IEEE Design and Test
4) IEEE Micro