COURSE OUTLINE

(1) GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	ELECTRICAL AND COMPUTER ENGINEERING DEPT.		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**ECE_K450**	**SEMESTER**	**4**
COURSE TITLE	DIGITAL CIRCUITS AND 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		
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*	Special background
PREREQUISITE COURSES:	There are no prerequisite courses. However, students should have sufficient knowledge of Digital Logic Design
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes.
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*

The main objective of the course is to familiarize students with digital sequential logic and understanding the concepts and methodology of designing combinational and synchronous and asynchronous sequential circuits and systems, as well as the learning of techniques and methods of analysis, design and simulation of the operation of sequential circuits and the use of specialized H/W and S/W tools for the analysis and design of digital circuits and systems.

Learning Outcomes

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

<u>At the knowledge level</u>

- Know the digital sequential logic principles and the related elements and circuits

- understand methodologies for analysis, design and operation of sequential logic circuits and systems commonly used
- have knowledge of software tools used to design and simulate sequential logic circuits and systems
- have knowledge of the hardware required to implement basic sequential circuits and systems with standard integrated circuits (chips).

At the skills level

- familiarize with the analysis and design of synchronous and asynchronous sequential circuits and systems
- be trained in using methods and techniques to study the behavior of sequential circuits and systems
- be trained in using specialized H/W and S/W tools for the design and simulation of digital circuits and systems

At the level of abilities

- select the proper components for designing and implementing digital sequential circuits and systems considering the functional requirements
- solve practical problems that arise during digital system design
- use software tools used to design and simulate logic circuits and 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 for, analysis and synthesis of data and information, with the use of the necessary technology
- Independent Work
- Teamwork
- Promotion of free, creative and inductive thinking

(3) SYLLABUS

The course covers key topics of digital sequential logic, as well as useful applications. It includes the description and behavior of memory circuits, the basic methods of analysis and design of synchronous and asynchronous sequential circuits, as well as the use of specialized hardware and software tools for the design and simulation of digital circuits and systems.

The course includes the following thematic areas:

Lectures

1. Synchronous sequential logic, basic memory circuits (latches and flip-flops)
2. Parallel and shift registers
3. Synchronous binary counters, modulo-N counters, parallel loading counters
4. Random access memory (RAM)
5. Finite state machines - Moore and Mealy models
6. Design of synchronous sequential circuits with finite state machines (Moore)

7. Design of synchronous sequential circuits with finite state machines (Mealy)
8. State minimization and state assignment
9. Analysis of synchronous sequential circuits
10. Asynchronous sequential logic, analysis and design processes
11. Ripple counters and asynchronous counters modulo-N
12. Circuits with latches, state reduction and state assignment in asynchronous sequential circuits
13. Hazards

Laboratory exercises

1. Familiarization with the laboratory H/W and S/W tools – Design and simulation of simple sequential circuits
2. Design and simulation of parallel and shift registers
3. Design and simulation of synchronous binary counters
4. Design and simulation of synchronous circuits using finite state machines methodology
5. Design and simulation of a sychronous circuit for recognition of a digital number sequence
6. Design and simulation of asynchronous binary counters

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
Face-to-face, Distance learning, etc.</td><td>Face-to-face in-class lecturing</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students</td><td>• Use of slides in electronic form (ppt).
• Lecture notes posted on the e-Class platform.
• Guides for each laboratory exercise posted on the e-Class platform.
• Suitable logic design and simulation H/W and S/W in the laboratory.
• Support of learning process through e-class platform.
• Use of e-mail to communicate with students</td></tr>
<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>
<table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<tr><td>Lectures</td><td>39</td></tr>
<tr><td>Study of lectures and bibliography</td><td>39</td></tr>
<tr><td>Laboratory Exercises (in Lab)</td><td>13</td></tr>
<tr><td>Lab exercises and problem solving</td><td>19</td></tr>
<tr><td>Preparation for exams</td><td>15</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course Total</td><td>125 hours (5 ECTS)</td></tr>
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</td></tr>
<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</td><td>• Written Final Examination (WFE) on the theoretical part of the course based upon solving exercises and problems of graduated difficulty. The partial grade points corresponding to each query are listed.
• Evaluation of laboratory exercises (ELE). Deliverables in electronic form and oral evaluation on their content.
• The final grade of the course is calculated as 0.7xWFE + 0.3xELE.</td></tr>
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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 examination process and the evaluation criteria for both, theoretical and laboratory part, are publicly available to the students through e-Class. • Language of evaluation: Greek

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- M. Morris Mano, M. D. Ciletti, Ψηφιακή Σχεδίαση, Εκδόσεις Παπασωτηρίου, 2018.
- M. Morris Mano, C. R. Kime, T. Martin, Σχεδίαση λογικών κυκλωμάτων και υπολογιστών, Εκδόσεις Τζιόλα, 2017.
- Μ. Ρουμελιώτης, Στ. Σουραβλάς, Ψηφιακή σχεδίαση: Αρχές & εφαρμογές, Εκδόσεις Τζιόλα, 2013.
- Κ. Παπαοδυσσεύς, Μ. Έξαρχος, Δ. Αραμπατζής, Φ. Γιαννόπουλος, Λογική σχεδίαση ψηφιακών συστημάτων, Εκδόσεις Τζιόλα, 2018.
- V. P. Nelson, H. Troy Nagle, J. David Irwin, B. D. Carrol, Ανάλυση και σχεδίαση κυκλωμάτων ψηφιακής λογικής, Εκδόσεις Επίκεντρο, 2007.
- J. F. Wakerly, Ψηφιακή σχεδίαση: Αρχές & πρακτικές, Εκδόσεις Κλειδάριθμος, 2005.
- S. Brown, Z. Vranesic, Σχεδίαση ψηφιακών συστημάτων με τη γλώσσα VHDL, Εκδόσεις Τζιόλα, 2014.

- Related academic journals: