COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF ELECTRONICS ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	2604004	**SEMESTER**	4
COURSE TITLE	Digital Systems Design		

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 (ECTS)**
Lectures	4	7
Laboratory	2	
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialisation Course
PREREQUISITE COURSES:	Logic Circuit Design (3rd Semester)
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO
COURSE WEBSITE (URL)	http://digilab.teipir.gr/index.php/edu/edu2

(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 course is based on the fundamental elements of logic circuit design offered by the prerequisite module on Logic Circuit Design and aims at the:

- consolidation of the design methodologies for combinational and sequential digital systems,
- knowledge and use of hardware description languages (VHDL) for system modeling and simulation,
- implementation of digital systems on reconfigurable programmable logic devices (CPLDs and FPGAs),
- study of different memory structures and technologies,
- experience acquisition on the complete digital system design cycle using CAD tools.

Upon successful completion of this course module students possess advanced knowledge, skills and competences in the subject of Digital Systems Design that enable them to:

- understand the functionality of digital systems,
- analyze and synthesize digital modules and circuits for a wide application range,
- design and implement hardware digital systems incorporating memory modules,
- model, simulate and implement digital circuits using hardware description languages and CAD tools,
- Interpret the specifications of programmable reconfigurable devices and select the appropriate for the application in hand.

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
- Working independently
- Team work
- Production of free, creative and inductive thinking

(3) COURSE CONTENT

Lectures

- Introduction
  - i. Hardware description languages
  - ii. Logic circuit synthesis
  - iii. Reconfigurable logic devices (CPLD, FPGA)
- VHDL principles
  - i. Behavioral description
  - ii. Structural description
- Building blocks of combinational and sequential circuits in VHDL (Logic gates, binary functions, multiplexers, flip-flops, registers, counters etc)
- Arithmetic units (Serial and parallel adder/subtractor, multiplier)
- Memory structures (RAM, ROM, EPROM, Flash).
- Synchronous sequential circuit design
- Digital system implementation technologies

Laboratory

Ten laboratory exercises covering all module topics either by using commercial CAD tools for design and simulation of digital circuits or by implementing low complexity modules on reconfigurable devices.

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
Face-to-face, Distance learning, etc.</td><td>Face to face lectures</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students</td><td>• Use of electronic presentation with multimedia content in class,
• Student support through the course webpage and the departmental e-learning platform,
• Electronic communication of instructors and students, through the course webpage and by e-mail.
• Use special software for modeling, simulation and implementation of digital systems in the lab.</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>Lectures, Laboratory experiments, study.

<table><tr><th>Activity</th><th>Semester workload (hours)</th></tr><tr><td>Lectures</td><td>52</td></tr><tr><td>Study for lectures</td><td>78</td></tr><tr><td>Laboratory experiments – digital system design problems</td><td>26</td></tr><tr><td>Report on lab experiments</td><td>26</td></tr><tr><td>Study and preparation for exams</td><td>28</td></tr><tr><td>Course Total</td><td>210</td></tr></table></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 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.</td><td>Final course grade = Lectures part grade x 60% + Laboratory part grade x 40%

The final written exam of the theoretical part of the module includes exercises and design problems of graded difficulty. The module content as well as test examples (solved and unsolved) are available to the students through the course web page. Students are allowed to bring any related book during examination.

The evaluation of the laboratory part is performed through:
• Oral or written test during lab exercise implementation (20%),
• Mid term exam (20%)
• Final exam (60%)</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

<u>Essential reading</u>

1. BROWN, ST.,VRANESIC, Z., Fundamentals of Digital Logic with VHDL Design, 3/e, McGraw-Hill Higher Education
2. V.A. Pedroni, Circuit Design and Simulation with VHDL, 2nd ed., The MIT press, 2010
3. KYRIAKIS-BITZAROS, E. D., Digital Systems Design Lab. Manual

Recommended Books

1. P.J. ASHENDEN, Digital Design (VHDL),An Embedded Systems Approach Using VHDL, 1st Ed., Morgan Kaufmann
2. MORRIS MANO, M., and KIME, C.R., Logic and Computer Design Fundamentals, Pearson Education, 4/e, 2008.
3. MORRIS MANO, M., CILETTI, M., Digital Design, 4/e, Prentice Hall.
4. GAJSKI D.D., Principles of Digital Design, Prentice Hall; 1/e, 1996.