COURSE OUTLINE

(1) GENERAL

SCHOOL	Engineering		
ACADEMIC UNIT	Department of Computer Engineering & Informatics		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	NY166	**SEMESTER**	4st
COURSE TITLE	Digital Electronics		

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
Laboratory exercises	2	2
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).	TOTAL	6

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized general knowledge Skills development
PREREQUISITE COURSES:	None
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://www.ceid.upatras.gr/el/undergraduate/courses/psifiaka-ilektronika https://eclass.upatras.gr/courses/CEID1076/

(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*

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

(1) Understand the operation of BJT, PMOS, NMOS transistors as digital gates as well as their noise margins.
(2) Understand and design CMOS circuits starting from logic functions and reversely
(3) Understand the function and design of flip-flop circuits and latches
(4) Design and understand the memory function of SRAM, DRAM, ROM types.
(5) Design and understand the operation of Dynamic Digital Circuits and Pass Transmitted Logic Circuits.
(6) Understand the operation of ECL circuits and design BiCMOS circuits.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

Working independently

Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

(3) SYLLABUS

A. Lectures and Tutorials

- INTRODUCTION TO DIGITAL ELECTRONICS
  - Ideal Logic Gates
  - Logic Level Definitions and Noise Margins
  - Dynamic Response of Logic Gates
  - Review of Boolean Algebra
  - NMOS Logic Design
  - Transistor Alternatives to the Load
  - Resistor
  - NMOS Inverter Summary and
  - Comparison
  - NMOS NAND and NOR Gates
  - Complex NMOS Logic Design
  - Dynamic Behavior of MOS Logic Gates
  - PMOS Logic
- COMPLEMENTARY MOS (CMOS) LOGIC DESIGN
  - CMOS Inverter Technology
  - Static Characteristics of the CMOS Inverter
  - Dynamic Behavior of the CMOS Inverter
  - Power Dissipation and Power Delay Product in CMOS
  - CMOS NOR and NAND Gates
  - Design of Complex Gates in CMOS
  - Minimum Size Gate Design and Performance
  - Dynamic Domino CMOS Logic
  - Cascade Buffers
  - The CMOS Transmission Gate
  - CMOS Latchup
- MOS MEMORY AND STORAGE CIRCUITS
  - Random Access Memory
  - Static Memory Cells
  - Dynamic Memory Cells
  - Sense Amplifiers
  - Address Decoders
  - Read-Only Memory (ROM)
  - Flip-Flops
- BIPOLAR LOGIC CIRCUITS
  - The Current Switch (Emitter-Coupled Pair)
  - The Emitter-Coupled Logic (ECL) Gate
  - Noise Margin Analysis for the ECL Gate
  - Current Source Implementation
  - The ECL OR-NOR Gate
  - The Emitter Follower
  - "Emitter Dotting'' or "Wired-OR'' Logic
  - ECL Power-Delay Characteristics
  - Current Mode Logic
  - The Saturating Bipolar Inverter
  - A Transistor-Transistor Logic (TTL) Prototype
  - The Standard 7400 Series TTL Inverter

B. Lab exercises

Exercise 1: Utilization of measurement devices, operational amplifier circuits (analog IC) with or without controlling resistors, and circuit operation analysis.
Exercise 2: Utilization of measurement devices, characteristics of logic IC families, and their temporal / operational attributes.
Exercise3: IC featuring flip flops, different types of flip flops, and circuits utilizing flip flops.
Exercise 4: Physical attributes of digital logic IC families.
Exercise 5: Logic IC featuring special attributes, analog IC oscillator, special topics

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
Face-to-face, Distance learning, etc.</td><td>Face-to-face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students</td><td>Wide use of ICT and more specifically :
・ The course is backed up by a web page providing all course material. This page is duly updated.
・ Homeworks are announced electronically through this page, submitted also through this page and marking for them is also announced electronically
・ The preferred communication method with the students is email.</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>26 hours</td></tr>
<tr><td>Tutorials</td><td>26 hours</td></tr>
<tr><td>Laboratory exercises</td><td>10 hours</td></tr>
<tr><td>Laboratory exercises preparation</td><td>35 hours</td></tr>
<tr><td>Lab report preparation</td><td>10 hours</td></tr>
<tr><td>Study – problem solving</td><td>42 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>153 hours</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>The evaluation is performed in Greek language and is based on two independent parts.

The theory evaluation is performed through a final written test that includes multiple choice questions, short-answer questions and problem solving. Sample solutions to the written test are announced so that a reference point for marking is provided. After the test marks are announced the students have the opportunity to see their mistakes.

The evaluation for the laboratory part is based:
・ on the functionality of the circuits implemented by the students during their lab exercise,
・ on the quality of documenting the circuits that they try to implement via their reports and
・ on a final oral exam in which they are asked to implement a small circuit and demonstrate its functionality</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

- *Suggested bibliography:*
・ Digital Design, Mano Morris, Ciletti Michael
・ Microelectronics, Jaeger Richard - Blalock Travis
・ Microelectronics Circuits, part B ADEL. S. SEDRA & KENNETH C. SMITH,

- *Related academic journals:*
・ IEEE Transactions on Circuits and Systems
・ IEEE Transactions on VLSI Systems