COURSE OUTLINE

(1) GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	ELECTRICAL AND COMPUTER ENGINEERING DEPT.		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**ECE_ELE850**	**SEMESTER**	**8**
COURSE TITLE	COMMUNICATION ELECTRONIC CIRCUITS		

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	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*	Specialised
PREREQUISITE COURSES:	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
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 course aims the student to deepen their knowledge on electronic circuits used in telecommunications focusing on high-speed electronics. Crucial concepts for telecommunications are presented, such as adaptation, noise, gain bandwidth product, detailed circuit analysis with emphasis on high frequencies such as clocked circuits, oscillators, transmitter and receiver circuits, preamplifiers, high frequency amplifiers, mixers and analog multipliers, as well as subcircuits of PLL/DLL topologies.

Learning Outcomes

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

<u>At the knowledge level:</u>

- know about the equivalent of a transistor at high frequencies.
- be aware of the problems of the operation of circuits at high speed.
- be aware of ways of interconnecting between high-speed circuits

- know of high-speed transceiver circuits
- recognize receiver's circuits, such as preamplifiers, timed comparators, limiters)
- know of species of oscillators and their function
- know about low noise amplifiers and their operation
- describe the locked phase loop function
- be aware of the analog configuration and implementation circuits (AM, FM, PM).
- recognize compensation subcircuits

At the skill level:

- design high-speed wired transmitter circuits
- design high-speed wired receiver circuits
- design high-speed wireless transceiver circuits
- design oscillators, LC and ring type
- design the structure of a PLL
- design the structure of a modulation circuit

At the level of abilities:

- recommend suitable circuits depending on the type of transceiver.
- select appropriate circuit data values for their adaptation.
- face circuit design problems due to implementation technology limitations.
- combine individual circuits with appropriate bias for the synthesis of transceiver circuits.
- evaluate the results of the analysis performed, by comparing them with the ones predicted by the theory.
- develop different methods of approaching and solving a circuit.
- evaluate specialized circuits of different communication protocols.

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
- Adapting to new situations
- Working independently
- Team Work
- Working in an international environment
- Production of free, creative and inductive thinking
- Criticism and self-criticism
- Production of new research ideas

(3) SYLLABUS

Short Course Description

Electronic circuits employed in telecommunications, focusing on high-speed electronics. Detailed description of high frequency circuits such as, oscillators (LC and ring), preamplifiers, high frequency amplifiers, mixers and analog multipliers, clocked circuits of receivers, transmitter circuits, as well as subcircuits of PLL/DLL topologies. Noise, gain bandwidth product, modulation.

Lectures

1. The transistor in high frequencies. Equivalents circuits of transitor in high frequencies, limitations and solutions, compensation.
2. High speed interconnections. Modeling of interconnection lines, adaptation.
3. Wireline transceivers. Circuits of wireline high speed transceiver, USB protocol.
4. Receiver circuits. Preamplifiers, amplifiers, clocked comparator, limiters.
5. Clocked comparators. Accuracy of Clocked comparators and compensation.
6. Mixers / analog multipliers.
7. High frequency amplifiers (RF / IF).
8. Voltage-controlled oscillator (VCO). The ring oscillator.
9. Voltage Controllers (VCO) (LC VCO). The LC oscillator
10. Locked Phase Loops -PLL (Analog - Digital). Phase detector.
11. PLL applications in telecommunications. Local oscillators / frequency composers, demodulators, clock and data recovery (CDR) subsystems.
12. Analog modulation and circuits (AM, FM, PM) (Part A)
13. Analog modulation and circuits (AM, FM, PM) (Part B)

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face in-class lecturing
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Slides (ppt) of the presentation of the theoretical part of the course, which will be available from the beginning of semester through e-Class. • Support of teaching procedure through the e-Class platform (notification of the teaching procedure, distribution of slides, supplementary material, announcements, relative links and literature, provision of test and the final examination).
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*	

Activity	***Semester workload***
Lectures	39
Tutorials	13
Project	13
Study and analysis of bibliography	60
Course Total	***125 hours (5 ECTS)***

STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure*	Final written exam that includes: 1. Solving exercises 2. Comparative evaluation of theory elements

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.*	

(5) ATTACHED BIBLIOGRAPHY

- *Suggested bibliography:*

1. Χατζόπουλος Α. Καρατζίδης Δ. Τηλεπικοινωνιακά Ηλεκτρονικά Κυκλώματα, Εκδόσεις Τζιόλα.
2. B. Razavi. Design of analog CMOS integrated circuits, McGraw-Hill Education*, 2017.*
3. P.R. Gray, P.J. Hurst, S.H. Lewis και R.G. Meyer, Analysis and Design of Analog Integrated Circuits, 4th edition, John Wiley and Sons, 2001.
4. R. Jaeger, T. Blalock: Microelectronics, 5th edition, McGraw-Hill, 2010.
5. S. Sedra, K. C. Smith, Microelectronic Circuits, 7th edition, The Oxford Sereies in Electrical and Computer Enginnering, 2017.
6. J. Millman, A. Grabel, Microelectronics, McGraw-Hill College, 2014.

- *Related academic journals:*

1. IEEE Transactions on Circuits and Systems I
2. IEEE Transactions on Circuits and Systems II
3. IEEE Transactions on VLSI
4. IEEE Transactions on Industrial Electronics
5. IET Electronics Letters
6. IET Circuits, Devices & Systems
7. International Journal of Circuits Theory and Applications
8. Journal of Circuits Systems and Computers
9. Journal of Circuits Systems and Signal Processing
10. International Journal of Electronics
11. Microelectronics Journal