COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF ELECTRONICS ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	2604001	**SEMESTER**	4
COURSE TITLE	RF Electronic Circuits 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	2	4
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:	Analog Electronics II (3rd Semester)
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES (in English)
COURSE WEBSITE (URL)	http://www.electronics.teipir.gr/academic_staff/Lecturer/RF%20Electronic%20Circuits%20Design.pdf http://www.electronics.teipir.gr/personalpages/Mytilinaios/RF_Theory/RF_Theory_index.html

(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 objective of this course module is to provide students with:

- Knowledge of feedback techniques and design of positive and negative feedback electronic circuits
- Design of RF oscillators using RC, LC and quartz components, as well as multivibrators and oscillator circuits using the 55 i.c.
- Knowledge of transceiver components and their functionality, and design of amplifiers, mixers and modulators at system level

- Analysis and design of passive and active filters.

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

- Locate, identify and tell apart positive and negative feedback designs in electronic circuits, list main positive and negative feedback effects;
- Draw block diagrams of electronic circuits with feedback loops for the basic classes of oscillators and signal generators;
- Identify, name and classify the major oscillator types and designs (RC, LC, quartz (XTAL)). Draw their block diagrams and produce basic design circuits. Assess the relative advantages of each type for given specifications and select the appropriate design among alternatives;
- Understand the notion of non-linearity and state its major consequences in circuit analysis and design methodology,
- Draw block diagram and describe in detail the operation of multivibrator circuits based on the 555 IC, in bistable, astable and monostable operating modes;
- Reproduce the full block diagram of RF transmitters and receivers (AM and FM modulation), name their components and explain the functionality of each (Local Oscillator, Mixer, RF amplifier, IF amplifier, envelope detector, smoothing filter, AF amplifier, AGC);
- Connect a prototype transceiver in the lab, for a given design, check connectivity and carry out measurements to verify operation characteristics;
- Perform detailed analysis and design of major passive and active filter classes;
- Assess relative merits of alternative designs for specific applications and select appropriate solutions.

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

(3) COURSE CONTENT

Positive and negative feedback; Barkhausen and oscillation criteria; Nyquist diagrams. RC, LC and quartz oscillators. Multi-vibrators; Oscillators with the 555 IC. Stagger amplifiers; Transceivers and components; modulators; low-noise amplifiers; passive and active filters.

Lectures:

Unit 1: Feedback and oscillation (3 lectures)

Unit 2: RC, LC and XTAL oscillators, VCOs, Multi-vibrators, 555-based circuits, (4 lectures),

Unit 3: Transceiver circuits: Mixers, Amplifiers and resonant amplifiers, Modulators and Convertors (4 lectures),

Unit 4: Passive and active filters of 1st and 2nd order (2 lectures).

Laboratory Experiments:

1. Harmonic Oscillators – Low and medium frequencies (Phase-shift, Wien bridge, Quadrature)
2. Harmonic Oscillators – High frequencies (LC – Hartley and Colpitts, XTAL)
3. Multi-vibrators based on 555 IC
4. Non-linear circuits (clippers)
5. Transceiver components (IF amplifiers, Local Oscillators, Mixers, RF amplifiers, Envelope detectors, Automatic gain (volume) control)
6. AM radio receiver (superheterodyne)

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to face lectures
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• 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.
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*	Lectures, Laboratory experiments, study. ***Activity*** / ***Semester workload (hours)*** Lectures: 26 Study for lectures: 26 Laboratory experiments: 26 Report on lab experiments: 26 Study and preparation for exams: 16 **Course Total**: ***120***
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*	Final grade is the weighted average of (i) Lecture part grade x 60% (ii) Laboratory part grade x 40% ***Lecture part grade:*** • Final written (80%) • Homework (20%) Final written exam is composed of

Specifically-defined evaluation criteria are given, and if and where they are accessible to students.	• questions on the taught material, that require both to recall knowledge and to use critical thinking in order to select among alternatives, • problem solving that requires full circuit analysis and synthesis capabilities, for all taught circuit classes. ***Laboratory part grade:*** Average of the grades received in each weekly Laboratory Experiment. Laboratory Experiments are performed on a weekly basis; participation is mandatory. Each experiment is assessed through (a) a written report turned in the following week x 40% (b) an oral examination on the experiment of previous week x 60%.

(5) ATTACHED BIBLIOGRAPHY

Essential reading

1. MILLMAN, J. and HALKIAS, C., Integrated Electronic Circuits, TEE Publications.

2. SEDRA, A. and SMITH, K.C., Microelectronic Circuits, Oxford University Press, 2009.

3. MALVINO, A. and BATES, D., Electronic Principles, McGraw-Hill Education, 2015.