COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF ELECTRONICS ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	2605002	**SEMESTER**	5
COURSE TITLE	Electronic Filters		

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:	Signals, Systems and Circuits (4th Semester)
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES (in English)
COURSE WEBSITE (URL)	http://filters.teipir.gr/HGD/Filters/Main_Filters.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*

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

1. Understand the operation of electronic filters and describe them in the frequency domain from their magnitude characteristics
2. Design lowpass, highpass, bandpass and band reject passive and active-RC filters with all-pole and rational approximations using the appropriate mathematics or filter tables.
3. Use software system simulation tools to verify filter specifications in the frequency domain
4. Use software tools to design frequency selective electronic circuits.
5. Collaborate with fellow students in a team, in order to solve complex filter design and implementation problems

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

1. Introduction to filter theory and design, ideal filters, filter specifications
2. Normalization, Frequency and impedance scaling
3. All-pole and Rational approximations
4. Butterworth lowpass approximation and determination of the transfer function
5. Chebyshev lowpass approximation and determination of the transfer function
6. Frequency transformations, design of highpass, bandpass and band reject filters
7. Active-RC realizations of the transfer function of the filter
8. Elliptic (Cauer) approximation and filter design
9. Introduction to passive filter design
10. Design of doubly terminated passive LC ladder filters using Butterworth, Chebyshev and Cauer approximations
11. Active-RC simulation of passive doubly terminated LC filters

Laboratory

1. Use of Mathematical software tools in circuit analysis and filter design (Mathcad, MATLAB)
2. Use of simulation software (PSpice)
3. Use of filter design software tools (Filter Solutions, FilterWiz, FilterPro, FilterCAD)

Weekly Laboratory exercises are designed every semester and students have to work on two filter design projects.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to face lectures

<table>
<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 of filter design and simulation software processes 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>52</td></tr><tr><td>Laboratory experiments</td><td>26</td></tr><tr><td>Report on lab experiments – projects</td><td>52</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>Student evaluation is performed in the language of instruction.

Final course grade = Lectures part grade x 60% + Laboratory part grade x 40%

<u>Lectures part grade:</u>
• Final written exam (100%)

Final written exam includes development questions and problem solving questions. Students are provided with a concise mathematic formulae consultation list.

<u>Laboratory part grade:</u>
• Oral evaluation in the lab, on a weekly basis
• Presentation and examination on two laboratory projects on filter design</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

<u>Essential reading</u>

1. Hercules G. Dimopoulos, Electronic Filters (Passive-Active), Basic textbook in Greek distributed to all students free of charge.
2. Hercules G. Dimopoulos, Electronic Filters, Springer

3. T. Deliyannis, Y. Sun, J.K. Fidler, Continuous-Time Active Filter Design, CRC Press
4. R. Schaumann, E. Van Valkenburg, Design of Analog Filters, Oxford University Press
5. L. D. Paarmann, Design and Analysis of Analog Filters, Kluwer
6. A. Williams, F. Taylor, Electronic Filter Design Handbook, McGraw Hill
7. S. Winder, Analog and Digital Filter Design, Elsevier
8. Wai-Kai Chen, The Circuits and Filters Handbook, CRC Press and IEEE Press
9. Kendall L. Su, "Analog Filters", Chapman & Hall
10. Paul M. Chirlian, "Signals and Filters", Van Nostrand Reinhold
11. G. Daryanani, "Principles of Active Network Synthesis and Design", John Willey