COURSE OUTLINE

(1) GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	COMPUTER ENGINEERING AND INFORMATICS DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	NY182	SEMESTER	2nd
COURSE TITLE	CIRCUIT THEORY		

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	4	4
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).	Total	4

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	General background Specialized general knowledge
PREREQUISITE COURSES:	PHYSICS (NY105)
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CEID1074/

(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*

Learning Objectives

Students will learn to

- Identify the principal *features of electric circuits or networks*: nodes, loops, meshes, and branches.
- Apply *Kirchhoff 's laws* to simple electric circuits.
- Apply the *passive sign convention* to compute the power consumed or supplied by circuit elements.
- Identify *sources* and *resistors* and their *i-v characteristics*.
- Apply *Ohm's law* and *voltage and current division* to calculate unknown voltages and currents in simple series, parallel, and series-parallel circuits.
- Correctly redraw a resistive network, as necessary, and compute the equivalent resistance between two nodes.
- Understand the impact of internal resistance in practical models of voltage and current sources as well as of voltmeters, ammeters, and wattmeters

- Compute the solution of circuits containing linear resistors and independent and dependent sources by using node analysis.
- Compute the solution of circuits containing linear resistors and independent and dependent sources by using mesh analysis.
- Apply the principle of superposition to linear circuits containing independent sources.
- Compute Thevenin and Norton equivalent circuits for networks containing linear resistors and independent and dependent sources.
- Use equivalent-circuit ideas to compute the maximum power transfer between a source and a load.
- Use the concept of equivalent circuit to determine voltage, current, and power for non-linear loads by using load-line analysis and analytical methods.
- Compute current, voltage, and energy of capacitors and inductors.
- Calculate the average and effective (root-mean-square) value of an arbitrary periodic waveform.
- Write the differential equation(s) for circuits containing inductors and capacitors.
- Convert time-domain sinusoidal voltages and currents to phasor notation, and vice versa; and represent circuits using impedances.
- Apply DC circuit analysis methods to AC circuits in phasor form.
- Understand the physical significance of frequency domain analysis, and compute the frequency response of circuits using AC circuit analysis tools.
- Analyze simple first- and second-order electrical filters, and determine their frequency response and filtering properties.
- Understand the meaning of instantaneous and average power, use AC power notation, compute average power, and compute the power factor of a complex load.
- Use complex power notation; compute apparent, real, and reactive power for complex loads; and draw a power triangle.
- Compute the capacitance required to correct the power factor of a complex load.

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…*
	…….

Working Independently
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

(3) SYLLABUS

- **Fundamentals of Electric Circuits**
  - Features of Networks and Circuits - Charge, Current, and Kirchhoff's
  - Current Law Voltage and Kirchhoff'S Voltage Law-Power and The Passive Sign Convention
  - I-V Characteristics and Sources - Resistance and Ohm'S Law
  - Resistors in Series and Voltage Division - Resistors in Parallel and Current Division

- Equivalent Resistance Between Two Nodes - Practical Voltage and Current Sources
- Measurement Devices - The Source-Load Perspective

- **Resistive Network Analysis**
  - Network Analysis - The Node Voltage Method - The Mesh Current Method
  - Node and Mesh Analysis with Dependent Sources-The Principle of Superposition
  - Equivalent Networks - Maximum Power Transfer - Non-Linear Circuit Elements
- **AC Network Analysis**
  - Capacitors and Inductors - Time-Dependent Sources
  - Circuits Containing Energy Storage Elements
  - Phasor Solution of Circuits with Sinusoidal Sources - Impedance - Ac Circuit Analysis
- **Frequency Response and System Concepts**
  - Sinusoidal Frequency Response- Low- and High-Pass Filters
  - Bandpass Filters, Resonance, Quality Factor
- **AC Power**
  - Sinusoidal Instantaneous and Average Power - Complex Power- Power Factor Correction

(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>Extended use of ICT. Specifically:
There are electronic links with Lecture notes (in Greek)
Main communication with the students is contacted via emails, and all announcements of the course are via eclass.</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>32 hours</td></tr>
<tr><td>Tutorials</td><td>16 hours</td></tr>
<tr><td>Study and analysis of bibliography</td><td>50 hours</td></tr>
<tr><td>Final Exams</td><td>3 hours</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td>101 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 language of evaluation is Greek. The final evaluation is by a written exam (3 hours) at the end of the semester. This exam contains: problems solving, short-answer questions, and multiple choice questions. On the forms of final examination the credits of each problem or question are indicated on the side, and written explanations are given on the forms, in order to indicate the student how to present his/her solutions or answer the questions.
One week after the test, indicative solutions are provided via eclass and, after the announcement of the final marks, every student has given time to inspect his answers and rise up his/her objections on the marking.</td></tr>
<tr><td></td><td></td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

PRINCIPLES AND APPLICATIONS OF ELECTRICAL ENGINEERING, G. Rizzoni and J. Kearns SIXTH EDITION, McGraw-Hill Education
MICROELECTRONIC CIRCUITS, A.S. Sedra and K.C. Smith, SEVENTH EDITION, Oxford University Press

- Related academic journals:

- IEEE Transactions on Circuits and Systems