COURSE OUTLINE

(1) GENERAL

<table>
<thead>
<tr>
<th>SCHOOL</th>
<th>ENGINEERING</th>
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</thead>
<tbody>
<tr>
<td>ACADEMIC UNIT</td>
<td>COMPUTER ENGINEERING AND INFORMATICS DEPARTMENT</td>
</tr>
<tr>
<td>LEVEL OF STUDIES</td>
<td>UNDERGRADUATE</td>
</tr>
<tr>
<td>COURSE CODE</td>
<td>CEID_NY108</td>
</tr>
<tr>
<td>SEMESTER</td>
<td>2nd</td>
</tr>
<tr>
<td>COURSE TITLE</td>
<td>ELECTRIC CIRCUITS</td>
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</table>

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

<table>
<thead>
<tr>
<th>WEEKLY TEACHING HOURS</th>
<th>CREDITS</th>
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<tbody>
<tr>
<td>Lectures</td>
<td>3+1</td>
</tr>
<tr>
<td>Laboratory exercises</td>
<td>2</td>
</tr>
</tbody>
</table>

Total 7

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

COURSE TYPE

General background
Specialized general knowledge

PREREQUISITE COURSES:

NO

LANGUAGE OF INSTRUCTION and EXAMINATIONS:

Greek

IS THE COURSE OFFERED TO ERASMUS STUDENTS?

NO

COURSE WEBSITE (URL)

https://

(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

A. THEORY

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.
Compete 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.

B. Laboratory Exercises

Students will learn to

- Use the digital oscilloscope in order to measure the charging and discharging of a capacitor in RC circuits, and obtain the time constant: $\tau = RC$ of the circuit.
- Use the digital oscilloscope in order to measure the phase shift between sinusoidal input and output signals in RC circuits.
- Create Lissajous images in a digital oscilloscope in order to estimate the phase difference between sinusoidal input and output signals in RC circuits.
- Use the digital oscilloscope in order to obtain the i-v characteristic of a resistance in a RC circuit.
- Use the digital oscilloscope in order to obtain the i-v characteristic of a diode.

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

SYLLABUS

- Lectures and Tutorials
  - Fundamentals of Electric Circuits
  - Network Analysis - The Node Voltage Method - The Mesh Current Method

  - Features of Networks and Circuits - Charge, Current, and Kirchhoff’s
  - 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

**Laboratory Exercises**
- **Lab 1**
  - The RC circuit.
- **Lab 2**
  - Phase shift measurements
- **Lab 3**
  - Lissajous curves
- **Lab 4**
  - Measurement of i-v characteristic of linear resistor
- **Lab 5**
  - Measurement of i-v characteristic of a diode
(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<thead>
<tr>
<th>DELIVERY</th>
<th>Face – to - face</th>
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</table>
| USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY | 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. |

<table>
<thead>
<tr>
<th>TEACHING METHODS</th>
<th>Activity</th>
<th>Semester workload</th>
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<tbody>
<tr>
<td>Lectures</td>
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<tr>
<td>Tutorials</td>
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<td>12 hours</td>
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<tr>
<td>Study and analysis of bibliography</td>
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<td>50 hours</td>
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<tr>
<td>Laboratory practice</td>
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<td>24 hours</td>
</tr>
<tr>
<td>Laboratory reports</td>
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<td>14 hours</td>
</tr>
<tr>
<td>Laboratory tutorials</td>
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<td>36 hours</td>
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<tr>
<td>Final Exams</td>
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<td>3 hours</td>
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<tr>
<td>Laboratory Exams</td>
<td></td>
<td>1 hour</td>
</tr>
<tr>
<td>Course total</td>
<td></td>
<td>176 hours</td>
</tr>
</tbody>
</table>

The language of evaluation is Greek.

B. THEORY
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.

B. Laboratory Exercises
The evaluation of laboratory exercises is based on:
- the functionality of the circuits and components examined in every exercise, oral examination during the laboratory work, and the report of the experimental measurements and results in every exercise.
- A final examination of one hour, where every student is examined separately on the lab bench. Marking is depending on his ability to perform selected measurements with a digital oscilloscope on a given circuit, and an oral examination after the end of his measurements.

(5) ATTACHED BIBLIOGRAPHY

- Related academic journals: IEEE Transactions on Circuits and Systems