(1) GENERAL

<table>
<thead>
<tr>
<th>SCHOOL</th>
<th>ENGINEERING</th>
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<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>NY165</td>
</tr>
<tr>
<td>SEMESTER</td>
<td>3rd</td>
</tr>
<tr>
<td>COURSE TITLE</td>
<td>BASIC ELECTRONICS</td>
</tr>
</tbody>
</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>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures and tutorials</td>
<td>4</td>
</tr>
<tr>
<td>Laboratory exercises</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>7</td>
</tr>
</tbody>
</table>

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:
CIRCUIT THEORY (NY182)

LANGUAGE OF INSTRUCTION and EXAMINATIONS:
Greek

IS THE COURSE OFFERED TO ERASMUS STUDENTS:
No

COURSE WEBSITE (URL)
Lectures: https://eclass.upatras.gr/courses/CEID1075/
Lab: https://eclass.upatras.gr/courses/CEID1119/

(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

Leacture and Tutorials
Students will learn to
- Understand the basic principles underlying the physics of semiconductor devices in general and of the pn junction in particular. Become familiar with the diode equation and i-v characteristic.
- Use various circuit models of the semiconductor diode in simple circuits. These are divided into two classes: large-signal models and small-signal models.
- Study practical full-wave rectifier circuits and learn to analyze and determine the practical specifications of a rectifier by using large-signal diode models..
- Understand the basic operation of Zener diodes as voltage references, and use simple circuit models to analyze elementary voltage regulators.
- Use the diode models presented in Section 9.2 to analyze the operation of various practical diode circuits in signal processing applications.
- Understand the basic principles of amplification and switching.
- Understand the physical operation of bipolar transistors; and determine the operating point of a bipolar transistor circuit.
- Understand the large-signal model of the bipolar transistor, and apply it to simple amplifier circuits.
- Select the operating point of a bipolar transistor circuit; understand the principle of small-signal amplifiers.
• Understand the operation of a bipolar transistor as a switch.
• Understand the classification of field-effect transistors.
• Learn the basic operation of enhancement-mode MOSFETs by understanding their \(i-v\) curves and defining equations.
• Learn how enhancement-mode MOSFET circuits are biased.
• Understand the concept and operation of FET large-signal amplifiers.
• Understand the concept and operation of FET switches.

**Laboratory Exercises**

Students will learn to

• Use the basic (active and passive) elements and sources in closed circuits, and perform electric measurements.
• Use the digital oscilloscope
• Select the operating point of a bipolar transistor circuit
• Use the BJT in small-signal amplifiers.

**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
- Project planning and management
- with the use of the necessary technology
- Respect for difference and multiculturalism
- Adapting to new situations
- Respect for the natural environment
- Decision-making
- Showing social, professional and ethical responsibility and
- Working independently
- 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

**Lectures and Tutorials**

- **Semiconductors and Diodes**
  - Electrical Conduction in Semiconductor Devices
  - The pn Junction and the Semiconductor Diode.
  - Large-Signal Models for the Semiconductor Diode
  - Small-Signal Models for the Semiconductor Diode
  - Rectifier Circuits - Zener Diodes and Voltage Regulation.

- **Bipolar Junction Transistors**
  - Amplifiers and Switches - The Bipolar Junction Transistor (BJT)
  - BJT Large-Signal Model
  - Brief Introduction to Small-Signal Amplification

- **Field-effect Transistors**
  - Field-Effect Transistor Classes - Enhancement-Mode Mosfets
  - Biasing Mosfet Circuits - Mosfet Large-Signal Amplifiers.
  - CMOS Technology and Mosfet Switches

**Laboratory Exercises**

- **Lab 1**
  - Measurement of resistances, electric current and voltage drop.

- **Lab 2**
  - Oscilloscope measurements in first-order RC circuits

- **Lab 3**
  - Diode circuits

- **Lab 4**
  - Amplifier Circuits with npn-type bipolar junction transistors-I

- **Lab 5**
  - Amplifier Circuits with npn-type bipolar junction transistors-II
### DELIVERY
Face-to-face, Distance learning, etc.

### USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students

- 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.

### 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.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Semester workload</th>
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<tbody>
<tr>
<td>Lectures</td>
<td>26 hours</td>
</tr>
<tr>
<td>Tutorials</td>
<td>13 hours</td>
</tr>
<tr>
<td>Study and analysis of bibliography</td>
<td>50 hours</td>
</tr>
<tr>
<td>Laboratory practice</td>
<td>35 hours</td>
</tr>
<tr>
<td>Laboratory reports</td>
<td>10 hours</td>
</tr>
<tr>
<td>Final Exams</td>
<td>3 hours</td>
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<tr>
<td>Laboratory Exams</td>
<td>1 hour</td>
</tr>
<tr>
<td>Course total</td>
<td><strong>148 hours</strong></td>
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</table>

### STUDENT PERFORMANCE EVALUATION
Description of the evaluation procedure

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 objections on the marking.

The evaluation of laboratory exercises is based on: the functionality of the circuits and components in every exercise, oral examination during the laboratory work, and the report of the experimental measurements and results.

### 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