

| <b>Programme of “Elettronica”<br/>“Electronics” - Introduction to Electronics</b>  |  |   |
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| <b>Number of ECTS credits: 9 (workload is 225 hours; 1 credit = 25 hours)</b>  |  |   |
| <b>I0632, Compulsory<br/>1st Cycle in INDUSTRIAL ENGINEERING, 2<sup>nd</sup> year , 2<sup>nd</sup> semester<br/>Teacher: <b>Giorgio Leuzzi</b></b> |  |   |
| <b>1</b>   | <b>Course objectives and Learning outcomes</b> | <p>The goal of this course is to provide the foundations for the analysis and design of basic electronic circuits and systems. Both digital and analog electronics are addressed, with special emphasis on performances and applications.</p> <p>On successful completion of this module, the student should understand the fundamental concepts of electronic circuits and systems, in connection with applications to information technology and electrical power management. The student should also be able to analyse and design basic electronic circuits and subsystems, and to practically realise and test them with basic laboratory instrumentation.</p>   |
| <b>2</b>   | <b>Dublin descriptors</b>                      | <p>Topics of the module include:</p> <p><b>Two-port networks and basic system concepts:</b> Matrix representations and linear equivalent circuits. Voltage and current gain, input and output impedance. Bandwidth, noise, power, dynamic range.</p> <p><b>Feedback networks:</b> Positive and negative feedback. Different feedback schemes. Stability, gain and bandwidth, impedances. Oscillation condition and oscillators.</p> <p><b>Operational amplifier :</b> Ideal and real OP AMP: main characteristics. Basic linear circuits with negative feedback. Basic nonlinear circuits with positive feedback.</p> <p><b>Electronic devices:</b> Diodes, Bipolar Junction Transistor (BJT), Metal-Oxide-Semiconductor Field-Effect Transistor (MOSFET). Structure, characteristic curves, linear and nonlinear models. Basic performances.</p> <p><b>Basic analog circuits:</b> Rectifiers, single-transistor amplifiers, differential amplifier. Bias, small-signal analysis, nonlinearities, transient.</p> <p><b>Basic digital circuits:</b> Logic gates, canonical synthesis, basic combinatorial circuits. Sequential circuits, examples of sequential circuits. Analog-to-digital and digital-to-analog conversion.</p> <p><b>Laboratory practice:</b> Examples of the described circuits are fabricated and measured with standard instrumentation.</p> <p>On successful completion of this module, the student should</p> <ul style="list-style-type: none"> <li>- have profound <b>knowledge</b> of basic principles of operation of electronic circuits.</li> <li>- have <b>knowledge and understanding</b> of the behaviour and of the main applications of basic electronic circuits,</li> <li>- <b>understand and explain</b> the performances and characteristics of simple electronic circuits and systems;</li> <li>- <b>understand</b> the fundamental concepts of electronic circuits and systems and their application to information and power management systems,</li> <li>- <b>demonstrate skill</b> in circuit analysis and design and <b>ability</b> to fabricate and test them;</li> <li>- demonstrate <b>capacity</b> for understanding problems of information and power management and for addressing their solution by means of electronic circuits and systems.</li> </ul> |
| <b>3</b>   | <b>Prerequisites and learning activities</b>   | The student must know the basic notions of general circuit theory, contained in the exams Fisica II and Elettrotecnica.   |
| <b>4</b>   | <b>Teaching methods and language</b>           | <p>Lectures, exercises and laboratory practice. Language: Italian / English</p> <p><b>Ref. Text books</b></p> <p>A.Sedra, K.Smith, <i>Microelectronic circuits</i>, 6<sup>th</sup> ed., Oxford University Press, 2012</p> <p>Italian translation: <i>Circuiti per la Microelettronica</i>, 4<sup>a</sup> ed., EdiSES Ed., 2012</p>  |

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| 5 | <b>Assessment methods</b> | Practical (laboratory) and oral exam. |
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