UNIVERSITÀ DI PAVIA

Anno Accademico 2018/2019

ELECTRONICS I (SURNAMES A-K)

Enrollment year	2017/2018
Academic year	2018/2019
Regulations	DM270
Academic discipline	ING-INF/01 (ELECTRONICS)
Department	DEPARTMENT OF ELECTRICAL,COMPUTER AND BIOMEDICAL ENGINEERING
Course	ELECTRONIC AND COMPUTER ENGINEERING
Curriculum	PERCORSO COMUNE
Year of study	2°
Period	(06/03/2019 - 14/06/2019)
ECTS	9
Lesson hours	100 lesson hours
Language	Italian
Activity type	WRITTEN AND ORAL TEST
Teacher	BONIZZONI EDOARDO - 3 ECTS MERLO SABINA GIOVANNA - 6 ECTS
Prerequisites	Students need to have a basic knowledge of differential calculus and complex numbers, of electromagnetic principles and of the analysis methods for electrical circuits (Kirchhoff's laws, Thevenin's and Norton's theorems, superposition principle, impedance of a linear network).
Learning outcomes	The course is meant to provide the basic knowledge in the electronic field, useful for understanding the operation and for the design of electronic systems in discrete component and integrated circuit technology. The topics include: linear and non-linear analog circuits with operational amplifiers, the diode, the MOS transistor and the basic amplification schemes with MOSFETs, the elementary logic gates, in particular in CMOS technology, and their characteristic parameters, digital memories. The course provides the student with the fundamental skills and

methodologies for electronic circuit analysis and design. At the end of the course, students will be able to perform AC and DC, small and large signal analysis of simple electronic circuits with operational amplifiers, diodes and MOS transistors. They will able to understand the structure and the operating principle of the basic electronic blocks for signal amplification and to recognize and assess the main specifications of electronic components.

Course contents

Analog and digital signals. Data processing and communication.

Linear circuits.
Amplifiers, their model and frequency response. Thevenin's and Norton's theorems. Response of single time constant (STC) networks in the frequency and time domain. Graphical representation of the frequency response through Bode diagrams.

Operational amplifiers.
Ideal operational amplifiers and relevant circuit models. Inverting and non-inverting configurations. Differential amplifier. Non-ideal features of the operational amplifier.

Diodes.
The semiconductor diode: structure and operating principle, current voltage characteristic and temperature behavior. Avalanche and Zener diode. Static circuits with diodes. Diode model for small and large signals.

Non-linear circuits with diodes.
Half and full wave rectifier. Peak detector. Limiting and clamping circuits.

Metal-oxide-semiconductor field-effect transistors (MOSFET)
Depletion MOSFETs: structure, operating principle, current-voltage characteristic. Enhancement MOSFET. Biasing the enhancement MOSFET in discrete component circuits. Small signal amplifiers with MOSFETs. Single stage amplifiers with common source, gate or drain. Current mirror. MOS amplifiers in integrated circuit technology with active load. CMOS amplifiers. Transmission gates with MOSFETs.

Digital circuits with MOS transistors.
Input-output characteristic of the inverter. CMOS inverter. Logic gates in CMOS technology. Bistable circuit (latch). Astable (waveform generators) and monostable (pulse generator) multivibrator. Random access memories (RAM) and read-only memories (ROM).

Teaching methods

Lectures (hours/year in lecture theatre): 44
Practical class (hours/year in lecture theatre): 32
Practical activities / Workshops (hours/year in lecture theatre): 16

Classroom lectures are given with computer presentations and are completed with practical classes, consisting of solving tests from previous years of the course. Workshop activities are carried out in the electronics teaching lab of the Department of Electrical, Computing and Biomedical Engineering (laboratorio didattico di elettronica, room B3)

	and consist of the characterization of simple electronic circuits with standard bench-top electronic instrumentation.
Reccomended or required readings	Microelectronic Circuits Seventh International edition Autori: Adel Sedra e Kenneth Smith The Oxford Series in Electrical and Computer Engineering ISBN: 9780199339143 On the KIRO website of the class, https://elearning2.unipv.it/ingegneria/course/view.php?id=214, copies of the presentations discussed during the lectures are available for downloading. F. Maloberti, G. Martini. Esercizi di Elettronica Applicata. Ed. Spiegel (1998), Milano (available in the library). F. Maloberti. Understanding Microelectronics: A Top-Down Approach. John Wiley and Sons, Chichester (2012) (available in the library). Y. Tsividis. A First Lab in Circuits and Electronics. John Wiley & Sons, Inc., New York (2002) (available in the library).
Assessment methods	The exam consists of a written test and an oral examination. 1) Written test. Open-book, open-notes written test consisting of two sections, each including at least three questions, assessing the student's knowledge and understanding of the course topics and problem solving capabilities. The test involves the analysis of simple circuits with operational amplifiers, diodes and transistors. The threshold grade to pass the written test is 18/30. 2) Oral examination. The oral examination can be taken only after passing the written test and it is meant to assess the student's knowledge and understanding of the course topics, problem solving capabilities and technical communication skills. It may become optional if the answers given to selected fundamental questions of the written test (indicated in the text) are correct. The final grade obtained without taking the oral examination cannot be higher than 26/30. The threshold to pass the exam is 18/30, best mark is 30/30 cum laude.
Further information	The exam consists of a written test and an oral examination. 1) Written test. Open-book, open-notes written test consisting of two sections, each including at least three questions, assessing the student's knowledge and understanding of the course topics and problem solving capabilities. The test involves the analysis of simple circuits with operational amplifiers, diodes and transistors. The threshold grade to pass the written test is 18/30. 2) Oral examination. The oral examination can be taken only after passing the written test and it is meant to assess the student's knowledge and understanding of the course topics, problem solving capabilities and technical communication skills. It may become optional if the answers given to selected fundamental questions of the written test (indicated in the text) are correct. The final grade obtained without taking the oral examination cannot be higher than 26/30.

	The threshold to pass the exam is 18/30, best mark is 30/30 cum laude.
Sustainable development goals - Agenda 2030	$lbl_legenda_sviluppo_sostenibile