UNIVERSITÀ DI PAVIA

Anno Accademico 2021/2022

ELECTRONICS FOR INDUSTRIAL MEASUREMENTS

Enrollment year	2021/2022
Academic year	2021/2022
Regulations	DM270
Academic discipline	ING-INF/01 (ELECTRONICS)
Department	DEPARTMENT OF ELECTRICAL,COMPUTER AND BIOMEDICAL ENGINEERING
Course	INDUSTRIAL AUTOMATION ENGINEERING
Curriculum	PERCORSO COMUNE
Year of study	1°
Period	1st semester (27/09/2021 - 21/01/2022)
ECTS	6
Lesson hours	57 lesson hours
Language	English
Activity type	WRITTEN TEST
Teacher	RATTI LODOVICO (titolare) - 2 ECTS RATTI LODOVICO (titolare) - 3 ECTS GRASSI MARCO - 1 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 an overview on electronics for application to industrial measurements. At the end of the course, the student is supposed to be able to: 1) recognize the most simple and popular amplification and filtering schemes and understand their operation; 2) analyze analog circuits based on operational amplifiers and combinatorial digital networks; 3) choose the values of component parameters based on the requirements of a specific application; 4) use an appropriate language in describing simple analog and digital circuits

	and their operation. The course also aims at providing students with the possibly needed tools to expand their knowledge of electronics beyond the course program.
Course contents	1) Introduction. Electronic chain for signal processing and acquisition: amplification, filtering, sampling, quantization, analog to digital conversion. 2) Circuits in the time domain, delta and step response. Circuits in the frequency domain, Fourier analysis and Laplace transform, impedance, frequency response and transfer function, Bode diagrams. 3) Ideal operational amplifier. Non-idealities in op amps. Negative feedback. Inverting and non-inverting amplifiers. Voltage buffer. Ideal integrator and differentiator. Difference amplifiers. Instrumentation amplifiers. 4) Signal filtering. Passive and active filters. 5) The diode. Electronic circuits with diodes. 6) Digital gates and combinational logic circuits. Analysis and synthesis of logic circuits. The MOSFET transistor. Digital gates in CMOS technology. Three-state gates. Multiplexers. 7) Review of analog-to-digital and digital-to-analog conversion. Sampling theorem and signal sampling, spectral representation of sampled signals, aliasing, quantization. Simple schemes for A to D and D to A conversion. 8) Instrumentation for electronic circuit characterization: oscilloscopes, multimeters, signal generators. 9) Experimental activity in the electronic laboratory. Design of circuits for signal conditioning. Signal acquisition and processing in the LabView environment.
Teaching methods	Lectures (hours/year in lecture theatre): 38 Practical class (hours/year in lecture theatre): 6 Practicals / Workshops (hours/year in lecture theatre): 12 Classroom lectures are given at the blackboard 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 (laboratorio didattico di elettronica, room B3) and consist of the design and implementation of systems for acquiring signals from transducers. Experience execution also involves using the bench top instrumentation available in the lab.
Reccomended or required readings	- A. Sedra, K. Smith. Microelectronic Circuits, International Sixth Edition. Oxford University Press, New York (2011). - P. Scherz, S. Monk, Practical Electronics for Inventors, Third Edition. Mac Graw Hill, New York (2013).
Assessment methods	The exam consists of a written and an oral section. 1) Written exam. Closed-book, closed-notes, 2 hour and 30 minute written exam consisting of 4 to 6 sections assessing the student’s knowledge and understanding of the course topics and problem solving capabilities. Threshold to pass the exam is 18/30, maximum mark is 30/30 cum

	laude. The final mark for the written exam will result from the weighted average of the marks obtained in each section of the written exam. 2) Oral exam. The oral exam is mandatory only if the marks in the written exam are below 23/30. Typical duration is 1/2 hour, including the revision of the written exam and 1-2 questions. The exam will assess the student's knowledge and understanding of the course topics, problem solving capabilities and technical communication skills. Threshold to pass the exam is 18/30, maximum mark is 30/30 cum laude. The final mark for the oral exam will result from the weighted average of the marks obtained for each question of the oral exam. The final mark for the overall exam will result from the weighted average of the written exam (70%) and the oral exam (30%) marks, plus the marks obtained in the evaluation of the laboratory report (from 0 to 2). Threshold to pass the exam is 18/30, maximum mark is 30/30 cum laude.
Further information	
Sustainable development goals - Agenda 2030	$lbl_legenda_sviluppo_sostenibile