UNIVERSITÀ DI PAVIA

Anno Accademico 2021/2022

ELECTRONICS FOR INDUSTRIAL MEASUREMENTS

Anno immatricolazione	2020/2021
Anno offerta	2021/2022
Normativa	DM270
SSD	ING-INF/01 (ELETTRONICA)
Dipartimento	DIPARTIMENTO DI INGEGNERIA INDUSTRIALE E DELL'INFORMAZIONE
Corso di studio	COMPUTER ENGINEERING
Curriculum	Embedded and Control Systems
Anno di corso	2°
Periodo didattico	Primo Semestre (27/09/2021 - 21/01/2022)
Crediti	6
Ore	57 ore di attività frontale
Lingua insegnamento	English
Tipo esame	SCRITTO
Docente	RATTI LODOVICO (titolare) - 2 CFU RATTI LODOVICO (titolare) - 3 CFU GRASSI MARCO - 1 CFU
Prerequisiti	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).
Obiettivi formativi	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.
Programma e contenuti	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.
Metodi didattici	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.
Testi di riferimento	- 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).
Modalità verifica apprendimento	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.
Altre informazioni	
Obiettivi Agenda 2030 per lo sviluppo sostenibile	$lbl_legenda_sviluppo_sostenibile