



UNIVERSITÀ
DEGLI STUDI
DI BRESCIA

Università degli Studi di Brescia

Corso di Studio	05821 - ELECTRONICS ENGINEERING
Insegnamento	750603 - INSTRUMENTATION ELECTRONICS, SENSORS AND MICROSYSTEMS
Anno Offerta	2023/2024
Responsabile	FERRARI VITTORIO
Periodo	Secondo Semestre
Modalità didattica	Convenzionale
Lingua	ita

ATTIVITÀ FORMATIVA DI RIFERIMENTO

Corso di Studio	05821 - ELECTRONICS ENGINEERING
Insegnamento	750603 - INSTRUMENTATION ELECTRONICS, SENSORS AND MICROSYSTEMS
Titolare	FERRARI VITTORIO

CAMPI

LINGUA INSEGNAMENTO

Italian, with learning material mostly in English.

CONTENUTI

The first part of the course deals with techniques and circuits for the extraction and processing of measurement information in electronic instrumentation, with special focus on sensor interfacing. The two combined aspects of signal amplification, plus mitigation of disturbing effects due to noise, interference and influencing quantities are jointly considered, with the general goal of maximizing signal-to-noise ratio.

The second part of the course deals with sensors and micro-electromechanical systems (MEMS). The main aspects treated are transduction effects, fabrication technologies and interfacing to signal-

conditioning electronic circuits. Techniques, development methods and devices are presented and discussed with reference to up-to-date applications and recent research trends, such as energy-harvesting for powering wireless autonomous sensors and microsystems, sensors for Internet of Things, wearable systems for monitoring physiological parameters.

LIBRI DI TESTO/LIBRI CONSIGLIATI

Lecture short-notes and support material prepared by the instructor and made available on line.

Reference textbooks:

- R. Pallás-Areny, J. G. Webster, “Sensors and Signal Conditioning” 2nd Edition, John Wiley & Sons, 2001.
 - S. D. Senturia, “Microsystem Design”, Kluwer Academic Publishers, 2001.
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OBIETTIVI FORMATIVI

The course is intended to provide skills and develop design abilities on electronic circuits and techniques for signal readout and treatment in instrumentation, and on sensors and microsystems.

PREREQUISITI

Electronic circuits and systems (analog, digital and mixed-signal), basics of signal theory, basics of semiconductor physics.

METODI DIDATTICI

Following a design-oriented approach, the course includes lectures on both fundamentals and more advanced topics, followed by a project-based laboratory activity where students agree with the instructor to deepen into specific topics of interest and design case studies.

ALTRE INFORMAZIONI

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MODALITÀ DI VERIFICA DELL'APPRENDIMENTO

Written test on the course contents, delivery of a written report on the laboratory project and oral presentation of the results.

The final grade comes from the weighted average of the results of the written test (maximum 32/30 points) and the report plus presentation (maximum 30/30 points).

PROGRAMMA ESTESO

Course syllabus

1. General concepts on information and signals, noise, interference and influencing quantities.
2. Amplification of DC and AC signal sources, electronic noise in circuits, electromagnetic interference (EMI) and mitigation of the same in cabled connections.
3. Techniques for information extraction and signal-to-noise ratio maximization: modulation and demodulation, phase-sensitive detection, lock-in amplifiers, filtering, averaging, correlation.
4. Introduction on sensors, actuators and transduction systems.
5. Microfabrication technologies and MEMS.
6. Sensor and microsystem design.
7. Sensor systems and applications.
8. Project-based laboratory activity.

DOCENTI ASSOCIATI

FERRARI MARCO

NASTRO ALESSANDRO
