



# UNIVERSITÀ DI PAVIA

Anno Accademico 2016/2017

## INDUSTRIAL INFORMATICS AND EMBEDDED SYSTEMS

<b>Anno immatricolazione</b>	2016/2017
<b>Anno offerta</b>	2016/2017
<b>Normativa</b>	DM270
<b>SSD</b>	ING-INF/05 (SISTEMI DI ELABORAZIONE DELLE INFORMAZIONI)
<b>Dipartimento</b>	DIPARTIMENTO DI INGEGNERIA INDUSTRIALE E DELL'INFORMAZIONE
<b>Corso di studio</b>	COMPUTER ENGINEERING
<b>Curriculum</b>	Embedded and Control Systems
<b>Anno di corso</b>	1°
<b>Periodo didattico</b>	Secondo Semestre (01/03/2017 - 09/06/2017)
<b>Crediti</b>	6
<b>Ore</b>	62 ore di attività frontale
<b>Lingua insegnamento</b>	ENGLISH
<b>Tipo esame</b>	SCRITTO E ORALE CONGIUNTI
<b>Docente</b>	LEPORATI FRANCESCO (titolare) - 5 CFU ATIENZA ALONSO DAVID - 1 CFU
<b>Prerequisiti</b>	Basic knowledge of electronics, industrial electronics, computer architecture and computer fundamentals.
<b>Obiettivi formativi</b>	The aim of the course is to provide competences and skills about informatics methodologies targeting industrial processes development and management. At the end of the course, students will be able to deal with computer interfacing with control systems, sensor data acquisition, driving typical industrial actuators, digital data communication and elaboration signal filtering and processing. The course aims, moreover, at introducing students to embedded systems, by offering an overview of typical hw/sw programmable architectures.
<b>Programma e contenuti</b>	Data acquisition Digital interfacing and signal edge/level detection; COTS components

driving (latch, buffer, counters). Electric and algorithmic filtering. Pulse signals acquisition: C source codes. Optical encoders: C source codes for velocity and position detection. Pulse signal output, numerical codes acquisition from contraves and absolute encoders. Multiplexing and ADC. Sigma/Delta converters. Linearization, calibration ARMA numerical filters, exponential, moving average filters.

#### Motor drivers

Hw-sw interface for DC motors and servomotors. Pulse Width Modulation and H-bridge devices.

#### Digital communication

Serial and parallel communications: bit, characters, message synchronization. Source code examples concerning IEEE GPIB 488, RS232, RS485 buses. Drivers for USART devices and point to point serial communication code example.

#### Numerical filters

Low-pass, High-pass, Band-pass, IIR and FIR filters, autoregressive moving-average (ARMA).

#### Field bus

Communication networks based on field buses. The Fip and Can protocols.

#### Embedded systems

ARM 7 processor architecture. Instruction set, memory access, source code assembly examples.

#### Metodi didattici

Lectures (hours/year in lecture theatre): 45  
Practical class (hours/year in lecture theatre): 0  
Practicals / Workshops (hours/year in lecture theatre): 0

#### Testi di riferimento

Wayne Wolf. Computer as components. Morgan Kaufmann. Reference text for the embedded systems lectures.

Lorenzo Mezzalana. Dispense di Informatica Industriale - Handouts of Industrial Informatics. Reference for lectures on digital and analog interface, on digital communication and field buses (in Italian language)

Francesco Leporati. Lectures slides. . Slides of the lessons, available at <http://gamma.unipv.it/infind>.

#### Modalità verifica apprendimento

The exam consists on a sequence of questions on the theory developed during the year and on exercises related to real industrial processes.

#### Altre informazioni

The exam consists on a sequence of questions on the theory developed during the year and on exercises related to real industrial processes.

#### Obiettivi Agenda 2030 per lo sviluppo sostenibile

[\\$lbl\\_legenda\\_sviluppo\\_sostenibile](#)