Manifesto of Studies 2025 -2026
PhD in Electronics, Computer Science and Electrical Engineering

The teaching activities of the doctoral course are organised into eight curricula:

Photonics,
Microwave Technologies,
Communication Systems,
Artificial Intelligence and Computer Vision
Cyber Physical Systems
Automation
Electrical Engineering
Mechatronics and Robotics

At the enrolment stage, each student is associated to a curriculum on the basis of his/her background and of the theme of the research project assigned by the tutor.
Each student must accumulate a total of at least 10 credits by attending and passing the examinations of the courses of the manifesto proposed by the PhD board.
In agreement with the tutor, the student may include courses from other curricula in his/her teaching plan if these are consistent with the training project.

Courses planned in the Academic Year 2025-26

Photonics

Theranostic Photonics: Sensing, Diagnostic, and Therapeutic Applications of Lasers

Lecturers: P. Minzioni, V. Bello
With this course we aim to offer an overview of the recent advances in biophotonics. The course will include an initial review to guarantee that all the students have the required knowledge in optics and photonics so that they can fruitfully attend the following lessons on advanced topics. The course will discuss some of the emerging fields in the biophotonics landscape, and will discuss their basic principles and applications
Course credits: 5 -First semester

Communication Systems - Microwave technologies

Polarimetric Synthetic Aperture Radar (SAR) and applications Polarimetric Synthetic Aperture Radar (SAR) and applications

Lecturer: A. Bhattacharya, Indian Institute of Technology Bombay, Mumbai, India
Main objective of the course: acquire theory and intuition on techniques for processing multivariate time series of measurements, develop understanding of radar/target interaction in spaceborne Earth monitoring. Learn about multi-temporal vegetation monitoring.
Course credits: 4 - Topics: Communication Systems, Microwave Technologies - Second semester

---

Artificial Intelligence and Computer Vision - Cyber Physical Systems

3D Computer Graphics

Lecturers: P Dondi, A. Gaggia (BeSharp)

The course aims to give an overview of 3D Computer Graphics (CG) and of its current applications in both research and industry. The course will include both the theoretical foundations of 3D CG and practical exercitations with 3D editors.

Course credits: 3 – Second Semester

Embedded systems design, communication and data acquisition

Lecturers: F. Leporati, E. Marenzi, E. Torti

The course addresses the design of digital embedded systems for all those applications into which processing performance should be combined with low power consuming, small footprint and customised resources. Due to the strong interactions with the environments into which these systems are "embedded" these themes are very hot and feature huge connections with several industrial fields (avionics, medicine and bioengineering, food and agriculture, …) allowing students to have a thorough vision of many disciplines tackled during the MD and PhD studies.

Course credits: 4,5 – Second Semester

Causal Deep Learning

Lecturer: M. Piastra

This course introduces the theoretical foundations of causal inference, covering core concepts, fundamental methods, and illustrative practical examples. Building on this foundation, the course explores how deep learning techniques can be integrated into causal inference frameworks to enhance their applicability and better exploit complex, high-dimensional data. Special attention is given to *normalizing flows* and their extensions for causal modeling, highlighting recent advances and potential applications.

Course credits: 3 – Second Semester

Automation

Systems and control colloquia I and II

Lecturers: E.M. Aiello, G. Galuppini, G. De Nicolao, A. Ferrara, L. Magni, C. Toffanin

The course aims at sharing methodologies and applications used and developed in the Identification and Control of Dynamic Systems Laboratory. A second goal is to improve the PhD students capability to present, discuss and critically evaluate scientific topics. In this respect, the PhD students will be an active part of the teaching through the presentation of their own research and during the open discussion periods. This teaching approach is typical of flipped learning.

Course credits: 3 - Automation – First and Second Semester

Mechatronics and Robotics

Industrial programming

Coordinator: H. Giberti

The objective of this course is to deepen the understanding of a range of programming languages and to obtain a critical understanding of the outstanding features of each of the languages.

Course credits: 4 - Second semester

Transversal technical courses

Bio-Inspired Materials and Technologies: A Pathway Towards Sustainability

Lecturer: Gabriele Greco. The course is part of the Design, Modeling and Simulation in Engineering PhD program offered by DICAr.

Course credits: 2,4 - First semester

Aim of the course: Equip students with the ability to analyze, model, and design systems and technologies inspired by biological structures and processes, with a focus on sustainable innovation.

Course structure: The course will be divided in two phases: 1) 4 hours of frontal lectures and 6 hours of lab/group activities. At the end, there will be a return phase (exam) in which the students will present their projects. The date of this return phase will be decided together with the students.