



Control Systems Engineering

Preparation of the study plan

INSTRUCTIONS

Common mandatory activities (69 cfu)

SYSTEMS THEORY 9 cfu (Year 1, Semester 1)

MACHINE LEARNING 9 cfu (Year 1, Semester 1)

DIGITAL CONTROL 6 cfu (Year 1, Semester 1)

ESTIMATION AND FILTERING 6 cfu (Year 1, Semester 2)

CONTROL LABORATORY 9 cfu (Year 1, Semester 2)

FINAL THESIS + INTERNSHIP/RESEARCH TRAINING $21+9=30$ cfu

(no language cfu for the 22-23 cohort)

The remaining activities of the study plan can be chosen by:

- selecting one of the 4 **suggested paths** (*Machine Learning, Robotics, Industrial Automation and Complex systems*); or
- by preparing a **customized plan** according to the student's interests.

Machine Learning Path



Required Path Courses (30 cfu)

Convex Optimization

Learning Dynamical Systems

Reinforcement Learning

Computer Vision (9cfu)

... followed by extra courses (21 cfu),
centered on emerging subfields:

“Advanced Control”

Nonlinear Systems & Control

Robotics and Control 1

Adaptive and Model Predictive
Control

“Methods and Models”

Game Theory

Neural Networks and DL

Learning from Networks

“Computation and measurements”

Big Data Computing

Measurements Architectures for
Cyber-Physical Systems

Robotics Path



Required Path Courses (33cfu)

Robotics and Control 1

Robotics and Control 2

Convex Optimization

Computer Vision (9cfu)

... followed by extra courses (18cfu),
centered on emerging subfields:

“Applied”

Industrial Robotics

Intelligent Robotics

Robotics Laboratory

“Industrial”

Electric Drives for Automation

Embedded Real-Time Control

Measurement Architectures for
CPS

“Learning”

Learning Dynamical Systems

Reinforcement Learning

“Advanced Control”

Nonlinear Systems & Control

Network Dynamical Systems

Industrial Automation Path



Required Path Courses (30cfu)

Convex Optimization

Embedded Real-Time Control

Industrial Automation

Modeling and Control of Electric Drives

... followed by extra courses (21cfu),
centered on emerging subfields.

“Applied”

Industrial Robotics*

Computer Vision (9cfu)

Measurement Architectures
for CPS

“Disruptive”

Reinforcement Learning*

Adaptive & MPCControl*

Information Security

Computer Vision (6cfu)

“Methodological”

Learning Dynamical
Systems*

Robotics and Control 1*

Complex Systems Path



Required Path Courses (30cfu)

Learning Dynamical Systems

Convex Optimization

Mathematical Physics

Nonlinear Systems and Control

... followed by extra courses (21cfu),
centered on emerging subfields.

“Advanced Control”

Nonlinear Systems & Control

Network Systems

Robotics and Control 1

Learning from Networks

“Algorithms”

Automata, Languages and
Computation

Quantum Information &
Computing

Game Theory

“System Biology”

System Biology

Control of Biological Systems

Math. Cell biology

Customized Path

Choose AT LEAST 42 CFU among the following courses.

Of those, AT LEAST 15 INTERGATIVE CFU and AT LEAST 15 CORE CFU.

Moreover, you can choose 9 elective cfu from any Master program of UNIPD (including the following list).

Convex Optimization (6cfu, INTEG.)

Mathematical Physics (9cfu, INTEG.)

Digital Signal Processing (6cfu, INTEG.)

Quantum Information and Computing (6cfu, INTEG.)

Neural Networks and Deep Learning (6cfu, INTEG.)

Measurement Architectures for Cyber-physical Systems
(9cfu, INTEG.)

Computer Vision (9cfu, INTEG.)

Computer Vision (6cfu, INTEG.)

Intelligent Robotics (9cfu, INTEG.)

Big Data Computing (6cfu, INTEG.)

Learning from Networks (6cfu, INTEG.)

Game Theory (6cfu, INTEG.)

Information Security (6cfu, INTEG.)

Automata, Languages and Computation (9cfu, INTEG.)

Control of Biological Systems (6cfu, INTEG.)

Smart Grids (6cfu, INTEG.)

Automotive and Domotics (9cfu, INTEG.)

Stochastic Processes (6cfu, INTEG.)

Modeling and Control of Electric Drives (9cfu INTEG.)

Mathematical Cell Biology (6cfu INTEG.)

Mathematical Methods for Optimization (6cfu INTEG.+3cfu
CORE) – not offered

Industrial Automation (9cfu CORE)

Learning Dynamical Systems (9cfu, CORE)

Robotics and Control 1 (9cfu, CORE)

Robotics and Control 2 (9cfu, CORE)

Adaptive and Model Predictive (6cfu, CORE)

Reinforcement Learning (6cfu, CORE)

Nonlinear Systems and Control (6cfu, CORE)

Embedded Real-Time Control (6cfu, CORE)

Network Systems and Dynamics (6cfu, CORE)

Network Systems (6cfu, CORE)

Systems Biology (6cfu, CORE)

Robotics laboratory (6cfu, CORE)

Industrial Robotics (9cfu, CORE)

Questions?

More info at:

<https://lauree.dei.unipd.it/lauree-magistrali/control-systems-engineering/>

Ask for help or suggestions by writing to:

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