Control Systems Engineering

Preparation of the study plan

INSTRUCTIONS

2023/24
Study Plan
Selection of courses and activities to be completed for graduation.  
**Total formative credit units: 120 – 126**

**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
The remaining activities of the study plan (51-57 cfu) can be chosen by:

- selecting one of the 4 **suggested paths** (Machine Learning, Robotics, Industrial Automation and Complex systems), with automatic approval;

- preparing a **customized plan** according to the student’s interests. It must be approved by the teaching committee.

All study plans must be submitted via UNIWEB.
Machine Learning Path

Path Courses
- Convex Optimization
- Learning Dynamical Systems
- Reinforcement Learning
- Computer Vision

30 path cfu + 6 control cfu
+15 elective cfu

“Computation and measurements”
- Big Data Computing
- Measurements architectures for cyber-physical systems

“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
- Network Dyn. Systems
Robotics Path

Path Courses
Robotics and Control 1
Robotics and Control 2
Convex Optimization
Computer Vision

“Learning”
Learning Dynamical Systems
Reinforcement Learning

“Advanced Control”
Nonlinear Systems & Control
Network Dynamical Systems

“Applied”
Industrial Robotics
Intelligent Robotics
Robotics Laboratory

“Industrial”
Electric Drives for Automation
Embedded Real-Time Control
Measurement Architectures for CPS

30 path cfu + 6 control cfu +15 elective cfu
Industrial Automation Path

**Core Courses**
- Convex Optimization
- Embedded Real-Time Control
- Industrial Automation
- Electric Drives for Automation

30 path cfu + 6 control cfu + 15 elective cfu

**“Methodological”**
- Learning Dynamical Systems
- Robotics and Control 1

**“Applied”**
- Industrial Robotics
- Computer Vision*
- Measurement Architectures for CPS

**“Disruptive”**
- Reinforcement Learning
- Information Security
- Computer Vision**
- Adaptive & MPControl
Complex Systems Path

**Core Courses**
- Learning Dynamical Systems
- Convex Optimization
- Mathematical Physics
- Nonlinear Systems & Control

**“System Biology”**
- System Biology
- Control of Biological Systems
- Math. Cell Biology

**“NL Dynamics”**
- Robotics and Control 1
- Robotics and Control 2
- Reinforcement Learning

**“Networks”**
- Network Dyn. Systems
- Learning from Networks
- Game Theory

**“Information”**
- Automata, Languages and Computation
- Quantum Information & Computing
- Game Theory

30 path cfu + 6 control cfu
+15 elective cfu
Customized Path and Full Course List

Rules for customized paths: Choose 51-57 CFU among the following courses. Of those, AT LEAST 15 CORE CFU and AT LEAST 15 INTEGRATIVE CFU. Moreover, you must choose 15 ELECTIVE CFU from any Master program of UNIPD (including the following list).

**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)

**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.)
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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