

ME-321

**Control systems + TP**

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Cursus	Sem.	Type
Electrical and Electronical Engineering	BA5	Obl.
HES - EL	H	Opt.
Mechanical engineering minor	H	Opt.
Mechanical engineering	BA5	Obl.
Space technologies minor	H	Opt.

Language of teaching	English
Credits	4
Session	Winter
Semester	Fall
Exam	Written
Workload	120h
Weeks	14
<b>Hours</b>	<b>4 weekly</b>
Courses	3 weekly
Project	1 weekly
<b>Number of positions</b>	

**Summary**

Provides the students with basic notions and tools for the analysis and control of dynamic systems. Shows them how to design controllers and analyze the performance of controlled systems.

**Content**

- Introduction to automatic control
- Closed-loop transfer functions
- Analysis of dynamic systems
- Design and analysis of PID controllers
- Loop shaping controller design
- State space analysis and control design
- Introduction to digital implementation

**Keywords**

Analysis and design of control systems, stability, PID control, loop shaping, state space control

**Learning Prerequisites****Required courses**

- Real analysis
- Complex analysis
- Physics
- Signals and systems

**Important concepts to start the course**

- Represent a physical process as a system with its inputs, outputs and disturbances and derive its dynamic equations, A1
- Represent a linear system by a transfer function

**Learning Outcomes**

By the end of the course, the student must be able to:

- Analyze a linear dynamical system (both time and frequency responses), A3
- Construct and analyse a discrete-time model for a dynamic system, A5
- Design a PID controller, A7
- Design a simple controller for a dynamic system, A8
- Assess / Evaluate the stability, performance and robustness of a closed-loop system, A12
- Define (specifications) the adequate control performance for dynamic systems, A13
- Propose several control solutions, formulate the trade-offs, choose the options, A14

### Transversal skills

- Set objectives and design an action plan to reach those objectives.
- Use both general and domain specific IT resources and tools
- Communicate effectively with professionals from other disciplines.
- Access and evaluate appropriate sources of information.

### Teaching methods

Lectures, written exercises, computer-based exercises and MOOC-based laboratory sessions

### Expected student activities

- Participate to lectures, exercises and laboratory sessions
- Homework of about 2 hours per week

### Assessment methods

Written exam

### Supervision

Office hours	No
Assistants	Yes
Forum	No
Others	<ul style="list-style-type: none"> <li>• Supervised written exercise sessions</li> <li>• Supervised MOOC laboratory sessions</li> <li>• Supervised hands-on computer sessions</li> </ul>

### Resources

#### Bibliography

Franklin, Powell and Emami-Naeini, "Feedback Control of Dynamic Systems, 7th Edition". Pearson publishing.

#### Ressources en bibliothèque

- [Feedback Control of Dynamic Systems / Powell. Ed.8, global](#)
- [Feedback Control of Dynamic Systems / Powell](#)

#### Notes/Handbook

Slides / notes available online.

**Moodle Link**

- <https://go.epfl.ch/ME-321>

**Prerequisite for**

- Multivariables Systems
- Advanced Control Systems
- Non-linear Control
- Model Predictive Control
- Identification of Dynamical Systems