EPFL

ME-301 | **Measurement techniques**

Mulleners Karen

Cursus	Sem.	Type
Mechanical engineering	BA6	Obl.

Language of teaching	English
Credits	4
Session	Summer
Semester	Spring
Exam	Written
Workload	120h
Weeks	14
Hours	**4 weekly**
Lecture	1 weekly
Practical work	3 weekly
Number of positions	

Summary

Theoretical and practical course on experimental techniques for observation and measurement of physical variables such as force, strain, temperature, flow velocity, structural deformation and vibrations, etc.

Content

This is a theoretical and practical course on the use of various experimental techniques related to mechanical engineering. The physical background, practical implementation, and limitations of common measurement methods will be taught through video lecture by various lecturers. The theoretical knowledge will be put in practice through independent group projects where students pick a topic and a question, design experiments, and measure different physical quantities such as force, strain, temperature, flow velocity, structural deformation and vibrations, etc. to solve their question.

Keywords

measurement techniques, data processing, experimental design, sensors

Learning Prerequisites

Important concepts to start the course

Basic understanding in:
- fluid mechanics, thermodynamics, heat and mass transfer
- electrical engineering / electronics
- numerical data analysis and processing

Learning Outcomes

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

- Carry out an experimental modal analysis of a real structure, S4

- Characterize experimentally the steady-state or dynamic response of solids, fluids S11

- Quantify the temperature, pressure, flow and composition of a fluid E24

- Propose mechanical tests for the characterization of biologic tissues and fluids B6

- Identify a dynamic system using experimental data A6

- Integrate similarity laws and their use for dimensioning an experimental testbed AH23

- Describe the technics used to measure physical flow quantities; choose the appropriate technic to measure to a desired accuracy AH24

Transversal skills

- Set objectives and design an action plan to reach those objectives.
- Use a work methodology appropriate to the task.
- Demonstrate a capacity for creativity.
- Continue to work through difficulties or initial failure to find optimal solutions.
- Write a scientific or technical report.
- Collect data.

Teaching methods

The physical background and working principles of various measurement techniques will be taught through video lecture by various lecturers. This knowledge will then be put into practice in the form of independent group projects. Students will pick a topic and they will be guided to systematically find answers by applying different measurement techniques they select. Support will be provided by teaching assistants during practice sessions.

Assessment methods

Final written exam (40%)
Scientific and technical report (60%)

Supervision

Office hours   Yes
Assistants   Yes

Resources

Bibliography

- Holman, J.P. "Experimental Methods for Engineers", https://mech.at.ua/HolmanICS.pdf
- Springer Handbook of Experimental Solid Mechanics
https://link.springer.com/referencework/10.1007/978-0-387-30877-7
- Springer Handbook of Experimental Fluid Mechanics
https://link.springer.com/referencework/10.1007/978-3-540-30299-5
- Organtini, G. Physics Experiments with Arduino and Smartphones. (2021).
https://link.springer.com/book/10.1007/978-3-030-65140-4
- Digital Signal Processing: An Experimental Approach
https://link.springer.com/book/10.1007/978-1-84800-119-0

Ressources en bibliothèque

- Organtini, G. Physics Experiments with Arduino and Smartphones
- Holman, J.P. "Experimental Methods for Engineers"
- Digital Signal Processing: An Experimental Approach
- Springer Handbook of Experimental Solid Mechanics
- Springer Handbook of Experimental Fluid Mechanics

Moodle Link

- https://go.epfl.ch/ME-301

Videos

- https://mediaspace.epfl.ch/channel/ME-301+Measurement+techniques/30161/subscribe