

MICRO-428

**Metrology**

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<b>Cursus</b>	<b>Sem.</b>	<b>Type</b>
Computational and Quantitative Biology		Opt.
Microtechnics	MA2, MA4	Opt.
Minor in Imaging	E	Opt.
Minor in Quantum Science and Engineering	E	Opt.
Quantum Science and Engineering	MA2, MA4	Opt.
Space technologies minor	E	Opt.

Language of teaching	English
Credits	3
Session	Summer
Semester	Spring
Exam	Written
Workload	90h
Weeks	14
<b>Hours</b>	<b>3 weekly</b>
Courses	2 weekly
Exercises	1 weekly
<b>Number of positions</b>	

**Summary**

The course deals with the concept of measuring in different domains, particularly in the electrical, optical, and microscale domains. The course will end with a perspective on quantum measurements, which could trigger the ultimate revolution in metrology.

**Content**

The course deals with the concept of measuring in different domains, particularly in the electrical, optical, and microscale domains. The concept of precision, accuracy, and resolution will be introduced early in the course with an embedded course on statistics, which provides the basics required to understand how proper measurements ought to be performed. Subsequently, the course will introduce electrical, optical, and mechanical metrology techniques dealing with intrinsic and extrinsic limitations of the measurement. The course will end with a perspective on quantum measurements, which could trigger the ultimate revolution in metrology. Homework will be used as a means to practice the concepts learnt in class.

**Syllabus**

- Classical metrology
- Basic statistics
- Electrical metrology
- Optical microscopy
- Optical imaging
- AFM
- SEM
- Quantum metrology

**Keywords**

Accuracy, precision, resolution, reproducibility, reliability, fidelity of the measurement

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

Basic mathematics/physics

**Recommended courses**

Design of experiments

**Learning Outcomes**

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

- Develop measurement setups that yield reproducible results
- Analyze the accuracy and precision of a measurement for a certain resolution
- Interpret the quality of data from measurements

### Transversal skills

- Demonstrate the capacity for critical thinking

### Teaching methods

Ex cathedra, exercises and homeworks. Q&A during lectures.

### Expected student activities

In-class presence and active participation strongly encouraged.

### Assessment methods

Self-assessment (ungraded homework, exercise session); final exam during exam sessions.

### Supervision

Office hours	Yes
Assistants	Yes

### Resources

#### Notes/Handbook

On Moodle: handouts of current year and recordings of previous lectures.

#### Moodle Link

- <https://go.epfl.ch/MICRO-428>

### Prerequisite for

MICRO-429 Metrology Practicals