

MICRO-428

**Metrology**

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Cursus	Sem.	Type
Microtechnics	MA2, MA4	Opt.
Minor in Quantum Science and Engineering	E	Opt.
Quantum Science and Engineering	MA2	Opt.

Contact language	English
Credits	3
Session	Summer
Semester	Spring
Exam	Oral
Workload	90h
Weeks	14
<b>Hours</b>	<b>3 weekly</b>
Lecture	3 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 provide 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

### **Assessment methods**

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

### **Resources**

#### **Notes/Handbook**

On Moodle: handouts and recordings of all lectures.

#### **Moodle Link**

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