

MICRO-605

**Optical MEMS and micro-optics**

Ataman Caglar

Cursus	Sem.	Type
Microsystems and Microelectronics		Opt.
Photonics		Opt.

Language of teaching	English
Credits	1
Session	
Exam	Written
Workload	30h
<b>Hours</b>	<b>14</b>
Lecture	14
<b>Number of positions</b>	<b>20</b>

**Frequency**

Every 2 years

**Remark**

November 14th to 17th, 2023 (Microcity, Neuchatel)

**Summary**

Micro-optics and optical MEMS encompass a wide range of methods, devices and systems that enable precise, high-speed manipulation of light at the wavelength scale. MICRO605 provides a comprehensive insight into this field, covering topics from fundamentals to applications.

**Content**

- 1. Optics at the micro-scale: An introduction (0.5 hours)**
- 2. Fundamental optical concepts (2.5 hours)**
  - 2.1. Gaussian beam propagation (0.5 hour)
  - 2.2. Scalar diffraction theory (1 hour)
  - 2.3. Interference and interferograms (1 hour)
- 3. Fundamental micro-electro-mechanical concepts (2 hours)**
  - 3.1. Actuation and position sensing (1 hour)
  - 3.2. Modeling of dynamic behavior (1 hour)
- 4. Building blocks of micro-optics (4 hours)**
  - 4.1. Scanning and pointing micromirrors (1 hour)
  - 4.2. Diffraction gratings (1 hour)
  - 4.3. Diffractive and refractive microlenses (1 hour)
  - 4.4. Optical micro-resonators (1 hour)
- 5. Applications (4 hours)**
  - 5.1. Projection displays (1 hour)
  - 5.2. Medical imaging (1 hour)
  - 5.3. Adaptive optics (1 hour)
  - 5.4. Optical switching (1 hour)
- 6. Emerging topics: A look into the imminent future (1 hour)**

**EXAM:**

Written report on a design study

**Learning Prerequisites****Recommended courses**

Basic knowledge of physics and mathematics  
 MICRO-621: Micro and Nanofabrication (MEMS)  
 MICRO-606: Scaling in MEMS

## Resources

### Bibliography

Micro-Optics: Elements, Systems and Applications, *edited by Hans Peter Herzig*

Fundamentals of Micro-Optics, *by Hans Zappe*

Optical MEMS, Nanophotonics, and Their Applications, *edited by Guangya Zhou & Chengkuo Lee*

MOEMS: Micro-Opto-Electro-Mechanical Systems, *by Manouchehr E. Motamedi*

Microsystem Design, *by Stephen Senturia*

Fundamentals of Microfabrication, *by Marc Madou*

Micro Electro Mechanical System Design, *by J. Allen*

Analysis and Design Principles of MEMS Devices, *by Minhang Bao*

### Références suggérées par la bibliothèque

- [Micro Electro Mechanical System Design](#), by J. Allen
- [Microsystem Design](#), by Stephen Senturia

### Moodle Link

- <https://go.epfl.ch/MICRO-605>