Summary
Introduction to optical imaging systems such as camera objectives and microscopes. Discussion of imaging formation. Principles of design of imaging optics with geometrical optics and analysis with raytracing. Presentation of different applications in photography and microscopy.

Content
• Light: electro-magnetic waves, scalar theory
• Statistical optics: temporal and spatial coherence
• Fourier optics representation of imaging
• Image quality - Point-spread function and optical transfer functions
• Detection of light: noise and detectors
• Microscopy: dark field, phase and polarization contrast, fluorescence
• Optical design; beam propagation code
• Holography, tomography, 3D imaging, confocal

Keywords
Optical imaging, optical instruments, optical design, performance analysis, aberrations, resolution and contrast, microscopy

Learning Prerequisites
Required courses
Micro 321 Ingénierie optique I
Micro 322 Ingénierie optique II
Analysis IV, Linear algebra, General physics III/IV

Recommended courses
Signals and systems, Image processing

Important concepts to start the course
Matrix calculations, Fourier transformation, Electromagnetic waves, refraction and reflection, polarization, signal filtering, basics of geometrical optics

Learning Outcomes
By the end of the course, the student must be able to:
• Sketch optical systems
• Estimate performance of optical systems
• Analyze imaging systems and the image quality
• Characterize the elements of imaging systems

Transversal skills
• Set objectives and design an action plan to reach those objectives.
• Communicate effectively with professionals from other disciplines.
• Continue to work through difficulties or initial failure to find optimal solutions.

Teaching methods
Lecturing with exercises

Assessment methods
During semester evaluation. Final written exam in the last day of class.

Supervision
Office hours       No
Assistants         Yes
Forum              No
Others             Possible to take dates

Resources
Virtual desktop infrastructure (VDI)
No

Bibliography
B.A. Saleh and M.C. Teich, Fundamental of photonics (2007)

Ressources en bibliothèque
• Introduction to Fourier optics / Goodman
• Fundamental of photonics / Saleh

Notes/Handbook
Course material and slides covering geometrical and matrix optics, Fourier optics, microscopy are published on Moodle

Moodle Link

• https://go.epfl.ch/MICRO-421