MICRO-421 **Imaging optics**

Psaltis Demetri

Cursus	Sem.	Type
Electrical and Electronical Engineering	MA2, MA4	Opt.
Life Sciences Engineering	MA2, MA4	Opt.
Microtechnics	MA2, MA4	Opt.
Photonics minor	E	Opt.
Photonics		Opt.

Language of teaching	English
Credits	3
Session	Summer
Semester	Spring
Exam	During the semester
Workload	90h
Weeks	14
Hours	**3 weekly**
Courses	2 weekly
Exercises	1 weekly
Number of positions	

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 analyis, 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

- Oral exam: drawing a question to prepare, expose and discuss
- No support allowed.

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)
H. Gross, Handbook of Optical Systems, Vol. 1 (2005)
H. Gross, Handbook of Optical Systems, Vol. 4 (2007)
J.W. Goodman, Introduction to Fourier optics (1996)

Ressources en bibliothèque

- Handbook of Optical Systems Vol.1 / Gross
- Handbook of Optical Systems Vol.4 / Gross

- 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