MICRO-420 **Selected topics in advanced optics**

Martin Olivier

Cursus	Sem.	Type
Electrical and Electronical Engineering	MA1, MA3	Opt.
Microtechnics	MA1, MA3	Opt.
Photonics minor	H	Opt.
Photonics		Opt.

Language of teaching	English
Credits	3
Session	Winter
Semester	Fall
Exam	Oral
Workload	90h
Weeks	14
Hours	**3 weekly**
Courses	3 weekly
Number of positions	

Summary

This course proposes a selection of different facets of modern optics and photonics.

Content

- Summary of fundamental optics (ray optics, Maxwell's equations, wave optics and polarization optics)
- Material properties and optical constants
- Light scattering
- Optics of metals and plasmoncis
- Gratings, stratified media and photonic crystals
- Metamaterials and metasurfaces
- Simple Matlab codes do study problems related to the previous topics

Keywords

Maxwell's equations, optics, photonics, polarization, material constants, dispersion, light scattering, Mie scattering, plasmonics, gratings, photonic crystals, metamaterials, metasurfaces.

Learning Prerequisites

Recommended courses

General knowledge of fundamental optics, e.g. courses Ingénierie Optique

Learning Outcomes

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

- Analyze an optics problem based on the laws of optics and electromagnetics
- Develop a model for this problem
- Synthesize the properties of different fundamental optical phenomena
- Elaborate a deep understanding of the underlying phenomena
- Model an optics problem using Matlab
- Explore an optical parameter range using Matlab

Transversal skills

- Assess one's own level of skill acquisition, and plan their on-going learning goals.
- Set objectives and design an action plan to reach those objectives.
- Use both general and domain specific IT resources and tools

Teaching methods

Ex-cathedra and exercises on Matlab.

Expected student activities

Participate actively during the lecture and during the exercises with Matlab. Go through the solution of the exercises and seek feedback when necessary.

Assessment methods

Oral exam.

Supervision

Office hours	Yes
Assistants	Yes
Forum	Yes

Resources

Virtual desktop infrastructure (VDI)

No

Bibliography

B.E.A. Saleh et M.C. Teich, "Fundamentals of photonics", 3rd Ed. Wiley (2019).
J.D. Jackson, "Classical electrodynamics", 3rd Ed. Wiley (1998).
J. Braat and P. Török, "Imaging optics", Cambridge University Press (2019).
A. Lipson, S.G. Lipson, and H. Lipson, "Optical physics", 4th Ed. Cambridge University Press (2011).
R.A. Chipman, W.-S.T. Lam and G. Young, "Polarized light and optical systems", CRC Press (2019).

Ressources en bibliothèque

- J. Braat and P. Török, "Imaging optics"
- R.A. Chipman, W.-S.T. Lam and G. Young, "Polarized light and optical systems"
- B.E.A. Saleh et M.C. Teich, "Fundamentals of photonics"
- J.D. Jackson, "Classical electrodynamics"
- A. Lipson, S.G. Lipson, and H. Lipson, "Optical physics"

Notes/Handbook

Provided on Moodle and during the lecture.

Moodle Link

- https://go.epfl.ch/MICRO-420