

MICRO-522

Integrated optics

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Cursus	Sem.	Type
Microtechnics	MA2, MA4	Opt.
Photonics		Obl.

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

Summary

The course is an introduction into optical waveguide, their concepts and applications. The focus is on basic principles, waveguide modes, their coupling, periodic structures in optical waveguides, devices, and applications.

Content

1. Electrodynamics fundamentals / Light waves at a boundary
2. Planar waveguides
3. Fiber optic modes
4. Coupling of radiation to and from waveguides
5. Fiber technology and basic devices
6. Periodic structures in waveguides
7. Coupled waves
8. Optical fiber sensors
9. Photonic crystal waveguides
10. Integrated optical components, and applications

Keywords

Total internal reflection, planar waveguides, two dimensional waveguides, optical fiber, fiber sensors, coupled waves, photonic crystal waveguides, integrated optical components

Learning Prerequisites**Required courses**

Bachelor in microengineering or in electrical and electronic engineering, or in physics.

Recommended courses

MICRO-420: Advanced optics

MICRO-421: Imaging optics

MICRO-422: Lasers and optics of nanostructures

MICRO-523: Optical radiation detection methods

Important concepts to start the course

Basics of optics, programming with MATLAB or similar, matrix calculations, Fourier transformation, electromagnetic waves, refraction and reflection, polarization, basics of geometrical optics, semiconductor physics, laser physics

Learning Outcomes

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

- Discuss planar, rectangular and circular waveguides
- Explain waveguide devices
- Compare periodic waveguide structures
- Analyze the properties of modes and classify waveguide modes
- Differentiate material from waveguide properties
- Assess / Evaluate the potential use of waveguides as sensors
- Develop a computer program to solve the planar and cylindrical wave equation

Transversal skills

- Manage priorities.
- Communicate effectively, being understood, including across different languages and cultures.
- Use both general and domain specific IT resources and tools

Teaching methods

Ex cathedra lectures
Problem solving exercises
Peer instruction, Clickers

Expected student activities

Regular attendance to lectures and exercises
Regular attendance to problem solving exercises
Matlab programming of waveguide modes

Assessment methods

oral exam

Supervision

Office hours	Yes
Assistants	Yes
Forum	No

Resources

Bibliography

Fundamentals of optical waveguides / Katsunari Okamoto, 2006
Fundamentals of photonics / B.E.A. Saleh, M. C. Teich, 2007
Integrated optics: theory and technology, vol. 33 / Hunsperger, 2009

Ressources en bibliothèque

- [Fundamentals of photonics / Saleh](#)
- [Integrated optics / Hunsperger](#)
- [Fundamentals of optical waveguides / Okamoto](#)

Notes/Handbook

Handout of course slides

Websites

- <http://poseidon.epfl.ch/english/software/article/professional-softwares.html>

Moodle Link

- <http://moodle.epfl.ch/enrol/index.php?id=483>