MICRO-423

Optics laboratories I

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

Language of teaching	English
Credits	3
Withdrawal	Unauthorized
Session	Summer
Semester	Spring
Exam	During the semester
Workload	90h
Weeks	14
Hours	**3 weekly**
TP	3 weekly
Number of positions	

It is not allowed to withdraw from this subject after the registration deadline.

Summary

This laboratory work allows students to deepen their understanding of optical instruments, optoelectronic devices and diagnostic methods. Students will be introduced in state of the art optical instruments and measurement principles.

Content

4 experiments on Fourier optics, optical fibers, lasers:

- Laser safety
- Optical fibers - Light injection, multi and single mode fibers
- Tunable diode laser – external cavity laser, MEMS grating
- Fourier Optics
- Solar cells charactersiation
- Fabry Perot interferometry
- Digital holography
- Plasmonics and spectroscopy
- Fibre amplifier
- Microwave optics
- Diode pumped Nd :YAG laser - frequency doubling
- Photoelasticity
- Liquid crystal electrooptics
- Camera objective and imaging

Keywords

Optical instruments, optical measurement techniques, Diode laser, He-Ne laser, Fourier optics, waveguide and fiber optics, error analysis

Learning Prerequisites

Required courses

Bachelor in

- Microengineering, or
- Electrical and electronic engineering, or
- Physics.

Recommended courses

MICRO-420: Advanced optics
MICRO-421: Imaging optics
MICRO-422: Lasers and optics of nanostructures
MICRO-523: Optical radiation detection methods
MICRO-321 Optical engineering I
MICRO-321 Optical engineering II

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:

- Apply principles of laser security
- Perform data analysis using excel and Matlab
- Assess / Evaluate the reliability of a measurement
- Perform an optical measurement
- Explain measurement results
- Estimate measurement errors

Transversal skills

- Manage priorities.
- Communicate effectively, being understood, including across different languages and cultures.
- Use both general and domain specific IT resources and tools
- Continue to work through difficulties or initial failure to find optimal solutions.
- Demonstrate the capacity for critical thinking
- Take feedback (critique) and respond in an appropriate manner.

Teaching methods

- Practical laboratory work in group (2 persons)
- 4 Experiments (2 afternoons each)

Expected student activities

Individual activity

- Participation at all experiments
- Execution of practical work

- Keep a Laboratory note book

Group activity

- Scientific/technical report writing per experiment

Assessment methods

Discussion of basic concepts during instruction (individual)
Evaluation of experimental work (individual)
Evaluation of written report (group)
Evaluation of laboratory notebook (individual)

Supervision

Office hours No

Resources

Bibliography

Fundamentals of photonics / B.E.A. Saleh, M. C. Teich, 2007
Integrated optics: theory and technology, vol. 33 / Hunsperger, 2009
An introduction to error analysis: the study of uncertainties in physical measurements, J. R. Taylor, University Science Books, 2nd ed., 1997
Fundamentals of optical waveguides / Katsunari Okamoto, 2006

Ressources en bibliothèque

- Fundamentals of photonics / Saleh
- Integrated optics: theory and technology / Hunsperger
- Fundamentals of optical waveguides / Okamoto

Notes/Handbook

Handout of course slides and documentation of individual experiments

Prerequisite for

MICRO-425 **Optics laboratories II**