GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2015-2016

Microphotonics (E900460)

Course size (nominal values; actual values may depend on programme)

Credits 6.0	Study time 180 h	Contact hrs	60.0 h

Course offerings and teaching methods in academic year 2017-2018

A (semester 1)	English	seminar: coached exercises	15.0 h
		project	15.0 h
		lecture	30.0 h
B (semester 1)	Dutch	seminar: coached exercises	15.0 h
		project	15.0 h
		guided self-study	30.0 h

Lecturers in academic year 2017-2018

Ottevaere, Heidi	VUB	lecturer-in-charge
Baets, Roel	TW05	co-lecturer
Meulebroeck, Wendy	VUB	co-lecturer
Van Thourhout, Dries	TW05	co-lecturer

Offered in the following programmes in 2017-2018	crdts	offering
European Master of Science in Photonics	6	A
Master of Science in Photonics Engineering	6	B

Teaching languages

Dutch, English

Keywords

diffraction, interference, waveguides, periodic structures and gratings, polarisation and anisotropy, microsystems

Position of the course

In depth treatment of fundamental concepts behind light propagation in a variety of photonic components and systems. The approach used in this course puts emphasis on the basic underlying theory as well as on analytic and computer aided design methods. Applications are briefly described.

Contents

- Introduction
- Matrix descriptions of wave propagation in linear systems: Transfer matrices and S-matrices (bidirectional), Representation of light polarisation (Jones, Stokes, Poincare), Jones and Mullermatrices
- Thin films: Reflection and transmission of layered media: tranfer matrix method, Coatings
- Fourier Optics: Diffraction theory: Fresnel and Fraunhofer, Fourier transform properties of lenses, Resolving power of imaging systems (MTF)
- Dielectric waveguides: Theory of slab and stripe waveguide, Numerical simulation methods for waveguide structures, Waveguide structures: bends, junctions, couplers
- Periodic media: Bragg condition, Surface and volume gratings, Grating spectrometers, Concepts of holography, Concepts of photonic crystals
- Photonic components and microsystems: Light modulators (electro-optical, acoust-optical, thermo-optical, electro-absorption), Polarisation based components (polarisation conversion, polarisers, isolators), Optical switching systems (scaling concepts, planar systems, 3D systems (MEMS))

- Optical measurement systems: Spectrometers (Fabry-Perot, FTIR, grating), Microscopy and profilometry
- Project

Initial competences

Introductory course on photonics and on electromagnetism.

Final competences

1 Understanding of transfer matrices, S-matrices, Jones matrices, Stokes parameters, Poincare sphere and Muller matrices.
2 Analysing thin films conceptually and by means of CAD tools.
3 Understanding of Fourier optics, Fraunhofer and Fresnel diffraction, Fourier transform properties of lenses, in MTF.
4 Understanding of waveguides.
5 Analyse waveguide modes by means of CAD tools.
6 Understanding of the diffraction behaviour of surface and volume gratings.
7 Understanding in the basic operation of the most important passive and active photonic components.
8 Understanding of the basic operation of optical measurement systems (spectrometers, microscopes, profilometers).

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Guided self-study, group work, lecture, project, seminar, seminar: coached exercises

Learning materials and price

Syllabus (in English)

References

- M. Born and E. Wolf, Principles of Optics, Pergamon Press
- M. Klein, T. Kurtak, Optics, John Wiley
- K. D. Möller, Optics, University Science Books
- J. Goodman, Introduction to Fourier Optics, McGraw Hill 1968
- R.Märtz , Integrated Optics, Design and Modeling, Artech House, Boston, London (ISBN 0-89006-668-X),
- C. Vassallo, Optical Wave Sciences and Technology, Part 1 Optical Waveguide Concepts, Elsevier

Course content-related study coaching

Evaluation methods

end-of-term evaluation and continuous assessment

Examination methods in case of periodic evaluation during the first examination period

Written examination, open book examination, oral examination

Examination methods in case of periodic evaluation during the second examination period

Written examination, open book examination, oral examination

Examination methods in case of permanent evaluation

Report

Possibilities of retake in case of permanent evaluation

examination during the second examination period is possible in modified form

Extra information on the examination methods

During examination period: written open-book exam complemented with oral examination. During semester: graded project reports. Frequency: About every two weeks, spread over the semester.

Calculation of the examination mark

Special conditions: 1 project based on a number of CAD-sessions: 30%. Exam: 70%.