GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2019-2020

Photonics (E030620)

Due to Covid 19, the education and evaluation methods may vary from the information displayed in the schedules and course details. Any changes will be communicated on Ufora.

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

Credits 4.0 **Study time 120 h** **Contact hrs** 45.0 h

Course offerings and teaching methods in academic year 2021-2022

A (semester 1)	English	Gent	self-reliant study activities	15.0 h
			seminar: coached exercises	30.0 h
0 (semester 1)				

Lecturers in academic year 2021-2022

Roelkens, Günther	TW05	lecturer-in-charge
Baets, Roel	TW05	co-lecturer

Offered in the following programmes in 2021-2022	**crdts**	**offering**
European Master of Science in Photonics	4	A
Master of Science in Photonics Engineering	4	A, 0

Teaching languages

English

Keywords

photonics, optics, optoelectronics, imaging systems, ray theory, electromagnetic wave theory, interference, lasers, semiconductors, optoelectronic components

Position of the course

The objective of this course is to acquaint the student with the basic concepts which are of relevance in the use of light in information systems as well as in energy systems and sensor systems. This includes geometric and physical optics, opto-electronics and laser systems. The general approach in this course is to focus on the understanding of basic concepts and on the ability to make use of methods to analyse these concepts quantitatively. The course also includes a limited amount of factual knowledge on existing materials, components and systems.

Contents

- Introduction: Photonics and its applications
- Propagation of light: Quantities and units of light, Geometrical optics, Scalar wave optics, Gaussian beam optics, Electromagnetic optics, Waveguide optics, Photon optics
- Laser systems: Gain, Laser cavities, Demonstration of laser types
- Optoelectronic components: Light-emitting components, Light-detecting components, Fabrication technology for optoelectronic components

Initial competences

This course builds on certain learning outcomes of the courses: Physics, Electromagnetism, Materials in electronics or Solid state physics and semiconductors at bachelor level.

Final competences

1 Knowledge with respect to the concepts: energetic and photometric quantities and units, ray approximation, paraxial matrixformalism for imaging systems, aberrations, dispersion and absorption, plane wave, reflection and refraction, interference, Gaussian beams, diffraction, Maxwell's equations, TEM plane wave, polarisation, Fabry-Perot etalon, waveguide modes, optical fiber, photons, photonflux statistics, lasers, gain, population inversion, Einstein relations, oscilation condition, pump systems, rate equations, cavity stability, laser modes, Q-

switching and mode locking, LEDs and laser diodes, photodiode, CCD, solar cell.

2 Understanding of imaging systems, of wave phenomena (interference and diffraction), of operation and diversity in laser systems, of technology and operation of semiconductor components

3 Analytical calculation skils with respect to simple lighting problems with incoherent sources, imaging systems with paraxial matrix method, Gaussian beam propagation, plane waves in 3-layer structures, basic characteristics of lasers.

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

Lecture, practicum, self-reliant study activities, seminar: coached exercises

Learning materials and price

Syllabus (less than 15 Euro)

References

- Fundamentals of Photonics, B.E.A. Saleh and M.C. Teich, John Wiley and Sons,1991, ISBN 0-471-83965-5

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

Skills test

Possibilities of retake in case of permanent evaluation

not applicable

Extra information on the examination methods

During examination period: written open-book exam complemented with oral examination

Calculation of the examination mark

The test during the semester has as purpose to acquaint the students with the examination style for this course. The test is scored but does not count for the final grade for the course.