Module Description

Applied Photonics

General Information

Number of ECTS Credits

3

Abbreviation

TSM_AppPhot

Version

11.02.2016

Responsible of module

Markus Michler, NTB (FHO)

Language

	Lausanne	Bern	Zürich
Instruction	☐ E ☐ F	☐ D ☐ E ☐ F	☐ D ☒ E
Documentation	☐ E ☐ F	☐ D ☐ E ☐ F	☐ D ☒ E
Examination	☐ E ☐ F	☐ D ☐ E ☐ F	☒ D ☒ E

Module category

☐ Fundamental theoretical principles - FTP

☒ Technical/scientific specialization module - TSM

☐ Context module - CM

Lessons

☒ 2 lecture periods and 1 tutorial period per week

Brief course description of module objectives and content

Applied photonics imparts knowledge on the subject of modern photonic devices and their applications. After a short optics brush-up, the student is introduced into the basic physics of light matter interaction. This subject leads into a detailed description on modern opto-electronics in the field of light detection systems and light sources. After a review of standard components, the student will be introduced to modern devices like single photon detectors, light emitting diodes and telecom semiconductor laser diodes. The third part of the course covers the subject of signal transmission in optical waveguides. The students will be introduced to the basic light guiding principle and the occurrence of fiber modes. Dispersion phenomena in waveguides and fibers will be discussed. Moreover, the students will be given an overview of different types of fibers and their appropriate field of application. For a better understanding of photonic systems the module will be completed with a detailed selection of photonic systems.

Aims, content, methods

Learning objectives and acquired competencies

- The student is familiar with the basic wave optical principles, interference phenomena, filters and gratings
- The student knows the main principles of light matter interaction
- The student has a clear picture of the main types of semiconductor light sources and detectors used today.
- The student knows the principles of light guiding in optical waveguides
- The student is familiar with different types of fibers and their field of applications
- The student knows how to assess coupling mechanisms to light sources
- The student knows how to select and apply sources, detectors and fibers for designing a system using photonics devices

Contents of module with emphasis on teaching content

- Basic physical optics, interference phenomena, filters and gratings (~10%)
- Light-matter interaction (absorption, emission, scattering) (~10%)
- Detectors: photodiodes, photomultipliers, CCDs, CMOS sensors and dedicated electronic circuits (~20%)
- Sources: LEDs, superluminescent diodes, laser diodes (~20%)
- Waveguide optics: Principles of light guiding in waveguides, types and properties of waveguides (e.g. fibers), waveguide and fiber modes, laser to waveguide coupling, dispersion properties of fibers and waveguides, etc. (~20%)
- Photonic systems will be introduced by illustrating typical applications in metrology, telecommunication and medical fields (~20%)

Teaching and learning methods

- Ex cathedra teaching
- Practical exercises
- Self study and discussion of papers

Prerequisites, previous knowledge, entrance competencies

- Optics: basics of wave and geometrical optics.
- Physics: Basic for engineers
- Electronics: Basic analog electronics

Literature

“Fundamentals of Photonics“, B.E.A. Saleh, M. C. Teich, Wiley & Sons
“Optoelectronics & Photonics”, S.O.Kasap, Prentice-Hall Inc.
“Optical electronics in modern Communications“ A. Yariv, Oxford University Press

Assessment

Certification requirements for final examinations (conditions for attestation)

none

Written module examination

Duration of exam :	120 minutes
Permissible aids:	Script (without exercises), Personal formulary