

# Applied Photonics

## General Information

### Number of ECTS Credits

3

### Module code

TSM\_AppPhot

### Valid for academic year

2020-2021

### Last modification

2019-11-06

### Responsible of module

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### Explanations regarding the language definitions for each location:

- Instruction is given in the language defined below for each location/each time the module is held.
- Documentation is available in the languages defined below. Where documents are in several languages, the percentage distribution is shown (100% = all the documentation).
- The examination is available 100% in the languages shown for each location/each time it is held.

	Berne	Lausanne	Lugano	Zurich
Instruction				X E 100%
Documentation				X E 100%
Examination				X E 100%

### Module Category

TSM Technical scientific module

### Lessons

2 lecture periods and 1 tutorial period per week

## Entry level competences

### Prerequisites, previous knowledge

- Optics: Basics of wave and geometrical optics;  
*without optics basics during bachelor studies, the EVA "Fundamentals of light" should be visited before visiting further TSM modules.*
- Physics: Basics for engineers (bachelor niveau)
- Electronics: Basic analog electronics (bachelor niveau)

## Brief course description of module objectives and content

Applied photonics offers an insight into various application areas of photonics, such as optoelectronics, waveguide optics, micro-optics and several application examples. Starting from the basic physics of light matter interaction, the module covers various topics of modern optoelectronics in the field of light detection systems and light sources. After an introduction to the basics of light guiding and the occurrence of fiber modes, loss and dispersion mechanisms in fibers are discussed. The module gives an overview of different types of fibers and shows the importance of single mode fibers, specialty fibers and integrated waveguides for modern photonic applications. Furthermore, microoptical components are introduced to emphasize their advantages for light shaping, beam guidance and fiber coupling. The module is rounded off by a selection of special applications such as optical telecom, fiber measurement and sensor technology, organic electronics, optical biosensors, smart lighting concepts or similar topics.

## Aims, content, methods

### Learning objectives and acquired competencies

After successfully completing this course the student

- understands the main principles of light matter interaction
- has a clear picture of the different types of semiconductor light sources and detectors used today
- knows how micro optics can be used to shape light in modern photonic systems
- knows the principles of light guiding in optical waveguides including losses and dispersion
- is familiar with different types of fibers and waveguides and their fields of applications
- knows how to select and apply sources, detectors, micro optics and fibers for designing photonic systems

### Contents of module with emphasis on teaching content

1. Fundamentals of light-matter interaction (absorption, emission, scattering) (1 week)
2. Optoelectronics (4 weeks):
  1. detectors: photodiodes, photomultipliers, CCDs, CMOS sensors and dedicated electronic circuits
  2. sources: LEDs, SLEDs, OLEDs, laser diodes
3. Micro-optics: ROEs and DOEs (1 week)
4. Fibers & Waveguides (4 weeks):
  1. modes in planar waveguides and fibers, loss mechanisms and dispersion
  2. single mode fibers, specialty fibers and integrated waveguides
5. Photonic systems (4 weeks):  
modern applications that illustrate the importance of optoelectronics, micro-optics and fiber optics like e.g. optical telecom, fiber metrology and sensing, organic electronics, optical biosensors, smart lighting concepts and many others more

### Teaching and learning methods

- Lectures and self-study
- Practical exercises

### Literature

Lecturers' scripts with references to current literature

Textbook: Optoelectronics & Photonics: Principles & Practices (2nd Edition), S.O. Kasap, Pearson Education Limited

## Assessment

### Certification requirements

Module does not use certification requirements

### Basic principle for exams

**As a rule, all the standard final exams for modules and also all repetition exams are to be in written form**

### Standard final exam for a module and written repetition exam

#### Kind of exam

written

#### Duration of exam

120 minutes

#### Permissible aids

*Aids permitted as specified below:*

Permissible electronic aids

none

**Other permissible aids**

Personal formulary: 4 A4 pages

**Special case: Repetition exam as oral exam**

**Kind of exam**

oral

**Duration of exam**

30 minutes

**Permissible aids**

*Aids permitted as specified below:*

**Permissible electronic aids**

No electronic aids permitted

**Other permissible aids**

Personal formulary: 4 A4 pages