COURSE DESCRIPTION CARD - SYLLABUS

Course name
Optoelectronics and photonics

Course

Field of study
Electronics and Telecommunications

Year/Semester
IV/VII

Area of study (specialization)

Profile of study
general academic

Level of study
First-cycle studies

Course offered in
English

Form of study
full-time

Requirements
elective

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
15	15	
Tutorials	Projects/seminars	

Number of credit points

3

Lecturers

Responsible for the course/lecturer:
Dr. Jan Lamperski

e-mail: jan.lamperski@put.poznan.pl

Responsible for the course/lecturer:

Prerequisites

Basic knowledge of mathematics, EM field theory, optics and optocommunications.

Programming in Matlab.

Ability to work in a group.

Course objective

In-depth knowledge and understanding of the design, operation and features of various optical devices used in optical transmission systems and equipment for the processing of optical signals.

Course-related learning outcomes

Knowledge

The student has knowledge of the physical behavior of passive and active optical components

Has knowledge of the features and possible applications of optical and optoelectronic materials

Understands physical principles of operation and construction of the selected optical elements and optoelectronic devices (directional couplers, modulators, photodiodes, lasers, optical amplifiers, optical filters, acousto-optical cell)

Understands the applications in which advanced photonics devices and sub-modules are used

Skills

Can define requirements and select appropriate optical elements for the specific application

Can calculate the basic parameters of optoelectronic components

Has design skills to define problems, identifies constrains propose solutions for specific applications to fulfill performance and required specification

Social competences

Has awareness of the necessity of professional approach to solving of technical problems

Understands the role of photonics in next-generation systems for signal processing and transmission

Is aware of the advantages of optical technology and necessity of transition from electronics to photonics

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Assessment of lecture material - written and/or oral form of 2-3 selected problems. Assessment of laboratory projects - presentation of lab group results.

Programme content

Duality of light: rays, waves, electromagnetism, quanta. Polarization of light. Electro- and acousto-optic effects. Nonlinear optics. Fundamentals of quantum mechanics.

Selected components of integrated optics: planar waveguides, coupled mode waveguides, electro-optic modulators, electro absorption (Franz-Keldysh) modulators, Mach-Zehnder type modulators, acousto-optic modulators.

Photonic fibers.

Optical resonators.

Optoelectronic semiconductor materials: electrical carriers, energy band-gap structure, direct indirect semiconductors.

Interaction of radiation with atoms.

Basic principles of light detection and emission in semiconductors. LED spectral characteristics. Optical amplifiers. Classification and properties of semiconductor lasers. Mode locked lasers.

Advanced modulation formats of optical signals. Wavelength conversion. All optical signal regeneration. Optical switching. All-optical signal processing. Optical frequency standards.

Laboratory problems follows the lecture material.

Teaching methods

Lectures are conducted in the multimedia form, problem oriented with students interaction.

Laboratoies focus on numerical exercises concerning specific optical effects, and simultaneously students work in groups on the assigned more complex problems concerning photonic devices.

Bibliography

Basic

The RP Photonics Encyclopedia: http://www.rp-photonics.com/encyclopedia.html

Optoelektronika, B. Ziętek, UMK, Toruń, 2004

Optical Electronics in Modern Communications, A. Yariv, Oxford University Press, N. York, 1998

Jan Lamperski, Optoelectronics and Photonics, lecture notes

Additional

Jan Lamperski, http://www.invocom.et.put.poznan.pl/~invocom/C/P1-9/swiatlowody_en/index.htm

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,0
Classes requiring direct contact with the teacher	31	2,0
Student's own work (literature studies, preparation for laboratory, preparation for tests, project preparation) [1]	44	1,0

[1] delete or add other activities as appropriate