COURSE DESCRIPTION CARD - SYLLABUS

Course name
Photonics [N2EiT1>FOTONIKA]

Course

Field of study
Electronics and Telecommunications

Year/Semester
1/1

Area of study (specialization)
–

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture
20

Laboratory classes
0

Other (e.g. online)
0

Tutorials
10

Projects/seminars
0

Number of credit points

5,00

Coordinators

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Lecturers

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Prerequisites

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

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

none

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Assessment of lecture material and tutorials - written and/or oral form of 2-3 selected problems.

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.
Problems follows the lecture material.

Course topics

Lectures:

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

Examples of exercises include:
Reflection on the materials interface
Properties of fiber and bulk Bragg periodical structures
Selected spectral properties of LEDs
Properties of optical resonators
F-P, DFB semiconductor lasers
Electro-optical effect
Pockels, Kerr modulator
Modulator/swich based on a directional coupler
Acousto-optical effect. AO Bragg cell
Mode-Locked Laser

Teaching methods

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

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	95	5,00
Classes requiring direct contact with the teacher	40	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	55	3,00