COURSE DESCRIPTION CARD - SYLLABUS

Course name
Optical Signal Processing [S1MiKC1>OPS]

Course

Field of study
Microelectronics and digital communications

Year/Semester
4/7

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
15

Laboratory classes
30

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

3,00

Coordinators

dr inż. Jan Lamperski
jan.lamperski@put.poznan.pl

Lecturers

Prerequisites

Basic knowledge of mathematics, optics, photonics and optical communication. Can solve basic problems in photonics, optoelectronics and telecommunications using mathematical tools

Course objective

Providing theoretical and practical knowledge in the modu;e of Optical Signal Processing concerning all-optical signal processing methods. To familiarize students with contemporary directions of development of microelectronics and optical and quantum communication, in particular with the issues of application of quantum electronics to implement ultrafast optical signal processing.

Course-related learning outcomes

Knowledge:
The student has knowledge of physical effects used for optical signal processing. K1_W02
Understands the operation and construction of selected systems used for OSP. K1_W12

Skills:
Is able to define requirements, specify parameters of OSP devices. K1_U05

Is able to compare and evaluate advantages and limitations of various devices used for signal processing. K1_U17

Social competences:
Understands the importance of optical processing methods (wavelength conversion, optical multiplexing, data format conversion, optical regeneration) in quantum microelectronics and telecommunications and understands the importance for the development of the ICT sector. K1_K05

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The knowledge acquired during the lecture is verified on the basis of a written assessment. The level of knowledge acquired and understanding of the lecture material will be assessed. Assessment will be in the form of a test. Thepassing threshold is 50% of points.
The skills acquired during laboratory classes are verified on the basis of completed exercises, tasks and mini-projects. It is required to obtain at least 50% of the maximum number of points.
Grading scale: <50% - 2.0 (ndst); 50% to 59% - 3.0 (dst); 60% to 69% - 3.5 (dst+) ; 70% to 79% - 4.0 (db); 80% to 89% - 4.5 (db+); 90% to 100% - 5.0 (bdb).

Programme content

Properties of optical waveguides. Dispersion. Selected nonlinear effects in optical fibers and optical devices (SPM, XPM, FWM, SGM, XGM). Selected problems of integrated optics.
Optical amplifier technology. Nonlinear properties of semiconductor optical amplifiers. Functional applications of amplifiers.
Nonlinear optical loop (mirror).
Application of Mach-Zehnder, Sagnac interferometers for optical signal processing.
Ultra-fast optical switching.
Optical wavelength convertion.
All-optical methods of signal multiplexing and demultiplexing (WDM, OTDM).
Optical 2R, 3R regeneration.
Regeneration of DPSK signals.
Optical SAW processors.
Implementation of the Fourier transform using a lens.
Optical methods of image recognition.

Course topics

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Teaching methods

Multimedia lecture enriched with computer simulations, problem-based with active student participation.
Computer analyses and laboratory demonstrations in the laboratories.

Bibliography

Basic:

The RP Photonics Encyclopedia: http://www.rp-photonics.com/encyclopedia.html, 2024
J. M. Senior, Optical Fiber Communications: Principles and Practice, Prentice Hall, N. York, 2009
G. P. Agraval, All Optical Signal Processing, prezentacje multimedialna. The Institute of Optics, University of Rochester, 2009-2019

Additional:
K. Gniadek, Optyczne przetwarzanie informacji, PWN, Warszawa, 1992
A. Yariv, P. Yeh, Phptonics, Optical Electronics in Modern Communications Oxford University Press, N. York, 2007

Breakdown of average student's workload

	Hours	ECTS
Total workload	85	3,00
Classes requiring direct contact with the teacher	45	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	40	1,50