COURSE DESCRIPTION CARD - SYLLABUS

Course name
Optical fiber communication systems [S2EiT2E-TIT>ZSŚ]

Course

Field of study
Electronics and Telecommunications

Year/Semester
1/2

Area of study (specialization)
Information and Communication Technologies

Profile of study
general academic

Level of study
second-cycle

Course offered in
English

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
15

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 optics and photonics Ability to specify the basic components required for the construction of optical links Ability to arrange for and carry out measurements of electrical signals and electronic copponents Ability to work in a group Understanding the importance of photonics in the development of telecommunications systems

Course objective

To provide students with theoretical and practical knowledge and understanding of optical communication systems. To prepare students to design, operate and maintain optical fiber systems.

Course-related learning outcomes

Knowledge:
Understands the operation of optical fiber communication components and systems

Skills:
Identify the main parameters of fibers, passive, active devices and submodules that effect the performance of optical communications systems

Operate the main components required for optical communication systems
Conduct experiments to develop and analyse an optical transmission system

Social competences:
Understands the need for further education
Understanding the importance of all-optical signal processing methods for telecommunications systems

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Assesment method: writen or/and oral exam. Written exam in test form consisting of approximately 10-18 questions, equally graded, customised for individual students. Passed with at least 50%.
The laboratory projects graded according to students" reports.

Programme content

Proposed lecture material, some modifications are possible at student"s request:
Optical propagation, acceptance angle, numerical aperture, optical modes, step index and graded index fibers, cut-off wavelength, single mode fibers.
Transmission characteristics of optical fibers: attenuation, modal, chromatic and polarisation dispersion. DWDM fibers. Linear and nonlinear propagation effects.
Passive network components. Integrated optics. Optical switching: technology and characteristics.
Optical sources and detectors.
Principles of optical amplifiers and classification. Gain and noise characteristics.
Application of OA to subscriber loops, trunk and undersea transmission systems.
Multiplexing methods: WDM, TCM, SCM and OTDM.
Optical multiplexing and amplification as method of upgrading fiber optic transmission systems.
Coherent optical fiber systems. Principles of coherent detection. Modulation formats. Demodulation schemes. Noise in coherent optical systems.
Advanced modulation formats.
Soliton transmission systems. Nonlinear wave motion in optical fibers. Soliton theory.
List of proposed lab projects:
-Optical spectrum analyser.
-Semiconductor light sources, laser controllers.
-Investigation of passive optical components.
-A/O Bragg cell - multiwavelength generation
-Mach-Zehnder fiber modulator.
-EDFA part I.
-EDFA part II.
-Tunable fiber ring EDFA laser.
-EDFA DWDM configuration.
-State of polarization measurement.
-PDL measurements.
-PMD / CD measurements.
-EDFA mode-locked pulse laser
-Coherent measurement of spectral linewidth
-E/O switch

Course topics

Lestures
Introduction
Modern Fibers - Optical Channel Effects
Modern Fibers - Nonlinear Effects
Optical Amplifiers
EDFA,
Numerical Simulation of EDFA
All Optical Siganal Processing
WDM Multiplexing

Coherent Detection
Coherent Systems
Advanced Modulation Formats
100G/400G Systems / UDWDM Systems
Soliton Transmission
Raman Amplifiers
System Design Methodology

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Teaching methods

Multimedia, problem oriented presentation.
Laboratory are carried out in teams. A leader is selected for each project. The leader is responsible for writing a report. The first tasks are selected by a lecturer and the remaining ones are chosen by students.

Bibliography

Basic
G. P Agrawal, Fiber-optic Communication Systems,Wiley-Interscience; 3rd edition, 2002
K. Perlicki, „Pomiary w optycznych systemach telekomunikacyjnych”, WKŁ, 2002
an Lamperski, http://www.invocom.et.put.poznan.pl/~invocom/C/P1-9/swiatlowody_en/index.htm
Additional
J. M. Senior, Optical Fiber Communications: Principles and Practice, Prentice Hall, N. York, 2009

Breakdown of average student's workload

	Hours	ECTS
Total workload	90	3,00
Classes requiring direct contact with the teacher	55	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	35	1,00