



COURSE DESCRIPTION CARD - SYLLABUS

Course name

Optical fiber communication systems [S2EiT1>ZSŚ]

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

full-time

Requirements

compulsory

Number of hours

Lecture

30

Laboratory classes

0

Other

0

Tutorials

15

Projects/seminars

0

Number of credit points

3,00

Coordinators

dr inż. Jan Lamperski

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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 components 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:

Assessment method: written 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.

Course topics

Lectures

Introduction

Modern Fibers - Optical Channel Effects

Modern Fibers - Nonlinear Effects

Optical Amplifiers

EDFA,

Numerical Simulation of EDFA

All Optical Signal Processing

WDM Multiplexing

Coherent Detection

Coherent Systems

Advanced Modulation Formats

100G/400G Systems / UDWDM Systems

Soliton Transmission

Raman Amplifiers

System Design Methodology

Examples of topics covered during the classes:

CD compensation methods (DCF fiber, FBG) and its impact on CWDM, WDM, DWDM transmission

Properties of optical semiconductor amplifiers

Properties of EDFA

FTTH optical link parameters - power budget and system dynamics, range and throughput limitations.

Analysis of a link with $BR \geq 10$ Gbps and a range of 80 - 100 km and methods for reducing limitations.

Analysis of the influence of dynamics and power budget (power penalty) - receiver sensitivity with direct detection

Application of WO in fiber and semiconductor technologies - noise problems.
Sensitivity analysis of a coherent receiver, modulation methods and influence on bandwidth and bit rate.
Soliton parameters
Properties of Raman amplifiers

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

R. Ramaswami, Optical Networks: A Practical Perspective, Elsevier, 2010

Jan 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

J. Siuzdak, Systemy i sieci fotoniczne, WKŁ, 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