STUDY MODULE DESCRIPTION FORM

Name of the module/subject	Code
Optical fiber communications	**1010805131010832041**

Field of study	Profile of study (general academic, practical)	Year /Semester
Electronics and Telecommunications	**general academic**	**2 / 3**
Elective path/specialty	Subject offered in:	Course (compulsory, elective)
-	**Polish**	**obligatory**

Cycle of study:	Form of study (full-time,part-time)
Second-cycle studies	**part-time**

No. of hours	No. of credits
Lecture: **20** Classes: **-** Laboratory: **10** Project/seminars: **-**	**4**

Status of the course in the study program (Basic, major, other)	(university-wide, from another field)
major	**from field**

Education areas and fields of science and art	ECTS distribution (number and %)
technical sciences	**4 100%**
Technical sciences	**4 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Basic knowledge of optics and photonics.
2	**Skills**	Describe basic components requireed for the construction of optical links. Ability to arrange and carry out measurements of electrical signals and electronic copponents.
3	**Social competencies**	Ability to work in a group. Understanding the importance of photonics in the development of telecommunications systems.

Assumptions and objectives of the course:

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.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. Understands the operation of optical fiber communication components. - [-K2_W08, K2_W13]

Skills:

1. Identify the main parameters of fibers, passive, active devices and submodules that effect the performance of optical communications systems - [-K2_U17, K2_U18]
2. Operate the main components required for optical communication systems. - [-K2_U17]
3. Conduct experiments to develop and analyse an optical transmission system. - [-K2_U17, K2_U16]

Social competencies:

1. Understands the need for further education. - [-K2_K05]
2. Understanding the importance of all-optical signal processing methods for telecommunications systems. - [-K2_K07]
3. Understands the dilemmas related to working in electronics and telecommunications. - [-K2_K08]

Assessment methods of study outcomes

Tests, lab project reports, written exam.

Course description

1. Optical propagation, acceptance angle, numerical aperture, optical modes, step index and graded index fibers, cut-off wavelength, single mode fibers.
2. Transmission characteristics of optical fibers: attenuation, modal, chromatic and polarisation dispersion. DWDM fibers. Photonic cristal fibers.
3. Linear and nonlinear propagation effects.
4. Passive network components. Integrated optics. Optical switching: technology and characteristics.
5. Optical sources and detectors.
6. Principles of optical amplifiers and classification. Gain and noise characteristics.
7. Application of OA to subscriber loops, trunk and undersea transmission systems.
8. Nonlinear device application of OA.
9. Multiplexing methods: WDM, TCM, SCM and OTDM.
10. Optical multiplexing and amplification as method of upgrading fiber optic transmission systems.
11. Coherent optical fiber systems. Principles of coherent detection. Modulation formats. Demodulation schemes. Noise in coherent optical systems.
12. Soliton transmission systems. Nonlinear wave motion in optical fibers. Soliton theory. Ultra high speed soliton systems.
13. Fiber optic system design methodology. Defining requirements. Component specification. System performance model and analysis. Network availability and cost performance.

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

Basic bibliography:

1. J. M. Senior, Optical Fiber Communications: Principles and Practice, Prentice Hall, N. York, 1994
2. G. P Agrawal, Fiber-optic Communication Systems,Wiley-Interscience; 3rd edition, 2002
3. J. C. Palias, Zarys telekomunikacji światłowodowej, WKŁ, 1991 (Fiber Optic Communications, Prentice Hall, Pearson Education, Inc., NewJersey 2005
4. K. Perlicki, Pomiary w optycznych systemach telekomunikacyjnych, WKŁ, Warszawa, 2002

Additional bibliography:

1. K. Perlicki, Systemy transmisji optycznej WDM, WKŁ, 2007
2. J. Siudak, Sieci fotoniczne, WKŁ, 2009
3. http://www.invocom.et.put.poznan.pl/~invocom/C/P1-9/swiatlowody_en/index.htm
4. http://www.rp-photonics.com/encyclopedia.html

Result of average student's workload

Activity	Time (working hours)

1. Participation in lectures	20
2. Participation in labs	10
3. Selfstudy	58
4. Exam	2

Student's workload		
Source of workload	**hours**	**ECTS**
Total workload	100	4
Contact hours	32	2
Practical activities	30	1