STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
Photonics		**1010805111010830861**
Field of study	Profile of study (general academic, practical)	Year /Semester
Electronics and Telecommunications	**general academic**	**1 / 1**
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: **10** Laboratory: **-** Project/seminars: **-**		**5**
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		**5 100%**
Technical sciences		**5 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Basic knowledge of mathematics, EM field theory, optics and optocommunications.
2	**Skills**	Able to use catalogues, extract required info from application notes.
3	**Social competencies**	Ability to work in a group.

Assumptions and objectives of the course:

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.

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

Knowledge:

1. The student has knowledge of the physical behavior of passive and active optical components - [-K2_W08]
2. Has knowledge of the features and possible applications of optical and optoelectronic materials - [-K2_W08]
3. Understands physical principles of operation and construction of the selected optical elements and optoelectronic devices (directional couplers, modulators, photodiodes, lasers, optical amplifiers, optical filters, acousto-optical cell. - [-K2_W08]
4. Understands the applications in which advanced photonics devices and sub-modules are used - [-K2_W08, K2_W13]

Skills:

1. Can define requirements and select appropriate optical elements for the specific application. - [-K2_U17]
2. Can calculate the basic parameters of optoelectronic components - [-K2_U17, K2_U18]
3. Has design skills to define problems, identifies constrains propose solutions for specific applications to fulfill performance and required specification - [-K2_U18]
4. Can effectively implement the occupational health and safety principles. - [-K2_U19]

Social competencies:

1. Has awareness of the necessity of professional approach to solving of technical problems. - [-K2_K05]
2. Understands the role of photonics in next-generation systems for signal processing and transmission - [-K2_K02, K2_K07]
3. Is aware of the advantages of optical technology and necessity of transition from electronics to photonics. - [-K2_K02, K2_K07]

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Assessment methods of study outcomes

Final test, colloquium, lab reports.

Course description

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. Optical computers. All-optical signal processing.

Optical Metrology. Optical frequency standards.

Basic bibliography:

1. Optoelektronika, B. Ziętek, UMK, Toruń, 2004
2. Optyczne przetwarzanie informacji, K. Gniadek, PWN, Warszawa, 1992
3. Optical Electronics in Modern Communications, A. Yariv, Oxford University Press, N. York, 1998
4. Pomiary w optycznych systemach telekomunikacyjnych, K. Perlicki, WKŁ, 2002
5. http://www.rp-photonics.com/encyclopedia.html

Additional bibliography:

1. Wstęp do optyki, J.R. Meyer-Arendt, PWN, Warszawa, 1979
2. http://www.invocom.et.put.poznan.pl/~invocom/C/P1-9/swiatlowody_en/index.htm

Result of average student's workload

Activity	Time (working hours)
1. Participation in lectures	20
2. Participation in classes	10
3. Selfstudy	93
4. Exam	2

Student's workload

Source of workload	hours	ECTS
Total workload	125	5
Contact hours	32	1
Practical activities	45	2

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