STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Optoelectronic and Photonics Devices and Technology**		Code **1010841171010833981**
Field of study **Electronics and Telecommunications**	Profile of study (general academic, practical) **general academic**	Year /Semester **4 / 7**
Elective path/specialty **Multimedia and Consumer Electronics**	Subject offered in: **Polish / English**	Course (compulsory, elective) **elective**
Cycle of study: **First-cycle studies**	Form of study (full-time,part-time) **full-time**	
No. of hours Lecture: **1** Classes: **1** Laboratory: **1** Project/seminars: **-**		No. of credits **2**
Status of the course in the study program (Basic, major, other) **major**	(university-wide, from another field) **from field**	
Education areas and fields of science and art **technical sciences** **Technical sciences**		ECTS distribution (number and %) **2 100%** **2 100%**

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**	Skills in the field of electronic metrology.
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 - [-K1_W02]
2. Has knowledge of the features and possible applications of optical and optoelectronic materials - [-K1_W02, K1_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. - [-K1_W21, K1_W08]
4. Understands the applications in which advanced photonics devices and sub-modules are used - [-K1-W24, K1_W21]

Skills:

1. Can define requirements and select appropriate optical elements for the specific application. - [-K1_U12]
2. Can calculate the basic parameters of optoelectronic components - [-K1_U08, K1_U20]
3. Has design skills to define problems, identifies constrains propose solutions for specific applications to fulfill performance and required specification - [-K1_U20]
4. Able to measure basic properties of optoelectronic components - [-K1_U17]

Social competencies:

1. Has awareness of the necessity of professional approach to solving of technical problems. - [-K1_K01]
2. Understands the role of photonics in next-generation systems for signal processing and transmission - [-K1_K04]
3. Is aware of the advantages of optical technology and necessity of transition from electronics to photonics. - [-K1_K04]

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, directional couplers, EAM (Franz-Keldysh), MZM, AOM.

Photonic crystal fibers. PCF supercontinuum.

Fabry-Perot resonator.

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 electrical and optical features. Lasers theory . Semiconductor optical amplifiers. Properties of F-P, DFB, DBR semiconductor lasers. Mode locked lasers.

Modulators for advanced modulation formats: PSK, QPSK, DQPSK, PolSK. Coherent detection. Detection of multileve optical signals. SOA: Wavelength conversion and regeneration. Nonlinear based all optical signal processing and regeneration (NOM, SL, SPM-MZI, XPM-MZI). Optical switching: MEMS, OE, LC, CI technology. Optical control loops: OIL, OPLL. Optical computers.

Optical comb generation. 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	15
2. Participation in classes	15
3. Participation in labs	15
4. Selfstudy	13
5. Final test	2

Student's workload

Source of workload	hours	ECTS
Total workload	50	2
Contact hours	35	1
Practical activities	30	1