FACULTY OF ELECTRICAL ENGINEERING

SUBJECT CARD

Name in Polish:	**Czujniki i komunikacja światłowodowa**
Name in English:	**Fiber Optics Communications and Sensors**
Main field of study (if applicable):	**Electrical Engineering**
Specialization (if applicable):	**Control in Electrical Power Engineering**
Level and form of studies:	**2nd level, full-time**
Kind of subject:	**obligatory**
Subject code:	**ELR042140**
Group of courses:	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU):	30		30		
Number of hours of total student workload (CNPS):	60		30		
Form of crediting:	crediting with grade		crediting with grade		
For group of courses mark (X) final course:					
Number of ECTS points:	2		1		
including number of ECTS points for practical (P) classes :			1		
including number of ECTS points for direct teacher-student contact (BK) classes:	1.40		0.70		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Student has structured and theoretically formed knowledge necessary to understand phenomena related to fiber optics and communications
2. Student has a basics knowledge on electromagnetic field theory
3. Is able to select properly, to connect as well as to coordinable performance of elements and fiber sensors in measuring transmission networks
4. Is able to perform properly and effectively basic research on operation parameters of both active and passive optoelectronic elements
5. Is able to conduct work in a team and understands the need for continuous education

SUBJECT OBJECTIVES

C1. Acquaintance of student with basic knowledge necessary to understand physical phenomena related to optoelectronic transmission of signals

C2. Acquaintance of student with modern structures of optoelectronic elements as well as with ways of processing and data transmission in optical networks

C3. Creation of skills and ability to create modern technique methods and measuring tools to test and design fiber optics communication networks

C4. The acquisition of practical knowledge and skills to apply and to complete fiber optics circuits carrying out measurements and preparation of test protocols

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 Knows structure and specifics of optical path work

PEK_W02 Has knowledge about optical phenomenon and optical elements dedicated for optical transmission

relating to skills:

PEK_U01 Is able to precise purpose and scope of research, project measurement circuit and select measurement equipment

PEK_U02 Is able to elaborate results and determine conclusions if about fiber guide condition

relating to social competences:

PEK_K01 Is conscious about responsibility for his own work and is willing to acknowledge teamwork rules

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours:**
Lec 1	Acquaintance with the subject, its program and the requirements of completion	2
Lec 2	Principles of wave theory of light propagation	2
Lec 3	Dielectric light guides, properties, basic parameters, fabrication	2
Lec 4	Problems of effective propagation of the light wave in fiber guides	2
Lec 5	Mechanisms of power losses in fiber guides: dispersion, refraction	2
Lec 6	Properties, classifications and operational parameters of the fiber guides	2
Lec 7	Light-emitting diodes (LED) as the light-wave source	2
Lec 8	Laser diodes (LD) as the light-wave source	2
Lec 9	Photodiodes, phototransistors and photoresistors in detection systems of the light-wave	2
Lec 10	Splices and optical connectors	2
Lec 11	Auxiliary, passive elements in fiber-optics networks and systems	2
Lec 12	Expanding optical system capacity by multiplexing	2
Lec 13	Digital and analog modulation of optical signals	2
Lec 14	Optical phenomena employed in fiber sensors	2
Lec 15	Completion quiz	2
	Total hours:	**30**

Form of classes - laboratory		**Number of hours:**
Lab 1	Introduction to the rules of safety (BHP) and to internal regulations applicable in the lab. Determination of completion criteria. General learning in the lab. Stands and acquaintance with physical models of optical and optoelectronics elements as well as with performance criteria	2
Lab 2	Measurement of attentuation of a multisegment fiber optics transmission system	2
Lab 3	Attenuation measurement of optical fiber guides	2
Lab 4	Testing of optical polarizer	2
Lab 5	Investigation of radiation angular characteristics of semiconductor lasers	2
Lab 6	Investigation of output spectrum and light-current characteristics of optical light source	2
Lab 7	Investigation of matching efficiency of optical connectors	2
Lab 8	Communication in BPL smart meters model (TCP/IP)	2
Lab 9	Communication in PLC smart meters model (PRIME)	2
Lab 10	Communication between devices using the MODBUS protocol (RS485)	2
Lab 11	Local Power Protection Operator - local point of the Control and Supervision System (SCADA)	2
Lab 12	GOOSE communication - IEC61850 compliant communication - Part I	2
Lab 13	MMS communication - introduction to IEC61850 compliant communication - part II	2
Lab 14	Access Gateway - communication (using DNP3 protocol) with remote monitoring center	2
Lab 15	Completion and arrears exercises	2
	Total hours:	**30**

TEACHING TOOLS USED
N1. Lecture with the use audiovisual techniques multimedia presentations, transparencies
N2. Laboratory measurements on physical models of the fiber optic elements and using PSP devices, conducted in the traditional manual in the groups

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT		
Evaluation *F – forming (during semester)* *P – concluding (at semester end)*	**Educational effect number**	**Way of evaluating educational effect achievement**
F1(W)	PEK_W01 PEK_W02	Oral or written completion test
P(W)	P=F1	
F1(L)	PEK_U01	Checking and assessment of preparation for lab exercises
F2(L)	PEK_U02	Evaluation of reports of performed exercises
P(L)	P=0,3F1+0,7F2	

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

Chai Yeh, Hanbook of Fiber Optics – Theory and Applications, Academic Press. Inc, London 1990.
Hornet J.L., Optical Signal Processing, Academic Press, Inc. London 1990.
Winkler W., Wiszniewski A., Automatyka zabezpieczeniowa w systemach elektroenergetycznych, WNT, Warszawa 2004.
Handbook of Optics Volume I-V, Mc Graw Hill Companies Inc.,Third Edition, USA 2010

SECONDARY LITERATURE:

Gagliardi R.M., Karp S., Optical Communications, Willey-int.Pub.
CIGRE Working Group 35.04, optical Cable Selection fo Electricity Utilities, Febr. 2001

SUBJECT SUPERVISOR

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
ELR042140 - Fiber Optics Communications and Sensors
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Electrical Engineering**
AND SPECIALIZATION **Control in Electrical Power Engineering**

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	S2CPE_W04	C.1 C.2	Lec2 Lec3 Lec4 Lec5 Lec6 Lec12 Lec13 Lec15	N.1
PEK_W02	S2CPE_W04	C.1 C.2	Lec7 Lec8 Lec9 Lec10 Lec11 Lec12 Lec13 Lec14 Lec15	N.1
PEK_U01	S2CPE_U05	C.3 C.4	Lab2 Lab3 Lab4 Lab5 Lab6 Lab7 Lab8 Lab9 Lab10 Lab11 Lab12 Lab13 Lab14	N.2
PEK_U02	S2CPE_U05	C.3 C.4	Lab2 Lab3 Lab4 Lab5 Lab6 Lab7 Lab8 Lab9 Lab10 Lab11 Lab12 Lab13 Lab14	N.2
PEK_K01	K2ETK_K06	C.1 C.2 C.3 C.4	Lec1 Lec15 Lab1 Lab15	N.1 N.2