(*faculty stamp*)

COURSE DESCRIPTION

1. Course title: FIBER OPTICS	**2. Course code FO**
3. Validity of course description: 2012/2013	
4. Level of studies: BA, BSc programme	
5. Mode of studies: intramural studies	
6. Field of study: Control, Electronic, And Information Engineering	(FACULTY SYMBOL) AEI
7. Profile of studies:	
8. Programme:	
9. Semester:	
10. Faculty teaching the course: Instytut Elektroniki, RAu3	
11. Course instructor: dr inż. Grzegorz Wieczorek	
12. Course classification:	
13. Course status: elective	
14. Language of instruction: English	
15. Pre-requisite qualifications: Course attendants are supposed to have general knowledge concerning basic electronic components and analog circuits. It is assumed that students passed the following courses: Physics, Introduction to Electronics.	
16. Course objectives: The course aims objectives include having the students got acquainted structure, properties and parameters of fiber optics and basic optoelectronic components applied in fiber optic transmission systems. Discussed in the lecture are fiber optic applications in telecommunication, configurations and types of connections, transmission and multiplexing techniques.	

17. Description of learning outcomes:

Nr	Learning outcomes description	Method of assessment	Teaching methods	Learning outcomes reference code
1.	Has got a basic understanding of the fiber optics structure and their properties	Final test	Lecture	
2.	Has got a basic understanding of passive and active elements used in fiber-optic transmission systems	Final test	Lecture	
3.	Able to establish basic parameters of the fiber optics and fiber optic connectors	Fulfilled laboratory exercises, final test	Laboratory	
4.	Able to perform the fiber optic link budget	Fulfilled laboratory exercises, final test	Laboratory	
5.	Able to establish parameters of the optoelectronic components used in simple fiber optic transmission system	Fulfilled laboratory exercises	Laboratory	
6.				
7.				
8.				

18. Teaching modes and hours

Lecture / BA /MA Seminar / Class / Project / Laboratory

Lecture -15 h., Laboratory -15 h

19. Syllabus description:

Lecture:

1. Types of fiber optics. Structure of single-and multimode fiber. Internal reflections. Nonlinear Phenomena. Properties.
2. Dispersion. Modal dispersion, material dispersion, waveguide dispersion and chromatic dispersion. Optical fibers with shifted and flat dispersion characteristics. Dispersion compensation. The product of bandwidth and distance BDP. The concept of mods, graphic

interpretation. Power distribution in the fiber cross-section. Dispersion in multimode step-index and graded refractive index optical fibers.

3. Attenuation in optical fibers. Attenuation characteristics and factors affecting the absorption. Transmission windows. Loss when connecting fiber. Connecting multimode optical fibers. Numerical aperture, numeric aperture mismatch. Axial displacement, angular displacement. Modes mixers, modes separators. Removable and permanent types of connections. Optical fiber cables - production, types and parameters.
4. Optical transmitters and modulators. Basic LED and LD driver circuits and their properties. Laser transmitters – direct and external modulation.
5. Optical receivers. Configurations, Noise sources, sensitivity.
6. Optical amplifiers and passive optical components. Semiconductor optical amplifiers, doped fiber amplifiers. Directional couplers, selective couplers, lenses, filters, attenuators, circulators, isolators, polarizers, polarization compensators.
7. Fiber optic networks. Multiplexing methods in fiber optic networks: WDM, FDM, SCM, TDM, OTDM, CDM. Multiple access methods WDMA , FDMA, TDMA, CDMA. Fiber network topologies.
8. Methods of measurement of optical fiber links. Optical power sources, optical power meters. Reflectometer - construction, principle of operation, discussion of measured quantities, properties, measurement methods.

Laboratory:

1. Determination of numerical aperture and acceptance angle of the optical fibers.
2. Coupling characteristics of the optical fibers.
3. Modems and fiber optic links. Measurement of the fiber optic modem. Optical link power budget, and the extent of transmission.
4. Optical Time Domain Reflectometer OTDR.
5. Optical fiber arc fusion splicing. Preparation and cutting of fiber.

20. Examination: no

21. Primary sources:

1. A. Majewski, „Teoria i projektowanie światłowodów", WNT, Warszawa 1991.
2. M. Marciniak, „Łączność światłowodowa", WKŁ, Warszawa 1998.
3. K. Booth, S. Hill**, "**The Essence of Optoelectronics", Prentice Hall, 1998
4. J. Siuzdak, „Wstęp do współczesnej telekomunikacji światłowodowej", WKŁ, Warszawa 1999.
5. J.D. Gibson, „The Communications Handbook – Second Edition", CRC Press, Boca Raton 2002.

22. Secondary sources:

1. K. Perlicki, „Pomiary w optycznych systemach telekomunikacyjnych", WKŁ, Warszawa 2002.
2. S. Haykin, „Communication Systems", 5ed, Wiley, 2009.

23. Total workload required to achieve learning outcomes

Lp.	Teaching mode :	Contact hours / Student workload hours
1	Lecture	15/0
2	Classes	/
3	Laboratory	15/15
4	Project	/
5	BA/ MA Seminar	/
6	Other	5/10
	Total number of hours	35/25

24. Total hours: 60

25. Number of ECTS credits: 2

26. Number of ECTS credits allocated for contact hours: 1

27. Number of ECTS credits allocated for in-practice hours (laboratory classes, projects): 1

26. Comments:

Approved:

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(date, Instructor's signature) (*date , the Director of the Faculty Unit signature)*