GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Fundamentals of Optical Fibers and Photonics, PG_00055350						
Field of study	Electronics and Telecommunications						
Date of commencement of studies	October 2023		Academic year of realisation of subject	2024/2025			
Education level	second-cycle studies		Subject group	Obligatory subject group in the field of study Subject group related to scientific research in the field of study			
Mode of study	Full-time studies		Mode of delivery	at the university			
Year of study	2		Language of instruction	English			
Semester of study	3		ECTS credits	2.0			
Learning profile	general academic profile		Assessment form	assessment			
Conducting unit	Department of Metrology and Optoelectronics -> Faculty of Electronics, Telecommunications and Informatics						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Jerzy Pluciński					
	Teachers	dr hab. inż. Jerzy Pluciński					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	15.0	0.0	0.0	30
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours	Self-study		SUM
	Number of study hours	30		4.0	16.0		50
Subject objectives	The aim of the course is to familiarize students with complex physical phenomena occurring in optical fibers, affecting their performance, with optical fibers used in telecommunications, specialty optical fibers, as well with advanced techniques of optical signal transmission, the construction of photonic devices, including chirp filters and devices using nonlinear optical phenomena.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W08] Knows and understands, to an increased extent, the fundamental dilemmas of modern civilisation, the main development trends of scientific disciplines relevant to the field of education.	He knows development trends related to increasing the fiber transmission speed and requirements for photonic devices used in systems with high binary rates.	[SW1] Assessment of factual knowledge
[K7_U02] can perform tasks related to the field of study as well as formulate and solve problems applying recent knowledge of physics and other areas of science	He can use the knowledge of optics in the interpretation of measurement results of modern fiber optic and photonic components or systems.	[SU1] Assessment of task fulfilment
[K7_W03] Knows and understands, to an increased extent, the construction and operating principles of components and systems related to the field of study, including theories, methods and complex relationships between them and selected specific issues - appropriate for the curriculum.	He knows and understands, to a greater extent, the structure and operation of fiber optics, chirp filters, elements that use non-linear optical phenomena.	[SW1] Assessment of factual knowledge
[K7_W02] Knows and understands, to an increased extent, selected laws of physics and physical phenomena, as well as methods and theories explaining the complex relationships between them, constituting advanced general knowledge in the field of technical sciences related to the field of study	He knows the physical phenomena used in photonic elements, knows associated effects associated with the relinquishing of optical radiation on matter.	[SW1] Assessment of factual knowledge
[K7_U06] can analyse the operation of components, circuits and systems related to the field of study; measure their parameters; examine technical specifications; interpret obtained results and draw conclusions	He obtains modes of optical radiation in optical waveguides. He examines the generation of second and higher harmonics in nonlinear crystals. He examines the properties of optical waveguides.	[SU1] Assessment of task fulfilment

Subject contents

1. Introduction (recommended literature, historic outline of developments in the fields of fibre optics and photonics).
2. Wave and electromagnetic description of modal propagation in optical fibre.
3. Analysis of mode coupling in optical fibres and its applications (directional couplers, Fibre Bragg Gratings).
4. Nonlinear phenomena in optical fibres.
5. Optical solitons and their applications.
6. Optical noise (intensity, phase and modal noise) and their impact on the transmission properties of optical fibres.
7. Photonic Crystals and Photonic Crystal Fibres.
8. Introduction to photonics definition of a photonic circuit and device, physical phenomena, transmission bandwidth of photonics circuits.
9. Nonlinear phenomena in photonic circuits.
10. Optical mixers gain, phase matching.
11. Optical amplifiers using stimulated emission and Raman scattering.
12. Selected photonic devices (logic gates, (de)multiplexers, optical routers).
13. Photonic measurement methods.
14. Optical interconnects in microelectronics.

Prerequisites and co-requisites

There are no requirements.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Colloquium - all topics from lectures	50.0%	20.0%
Active participation during laboratory exercises - all laboratory exercises must be passed	50.0%	80.0%

Recommended reading

Basic literature

1. Y. S. Kivshar, G. P. Agrawal: Optical Solitons: From Fibers to Photonic Crystals. Academic Press, San Diego, 2003.
2. J. D. Joannopoulos, S. G. Johnson, J. N. Winn, R. D. Meade: Photonic Crystals: Molding the Flow of Light, 2nd Edition. Princeton University Press, Princeton, 2008.
3. B. E. A. Saleh, M. C. Teich: Fundamentals of Photonics, 2nd Edition. John Wiley & Sons, New York, 2007.
4. G. P. Agrawal: Nonlinear Fiber Optics, 4th Edition (Optics and Photonics). Academic Press, London, 2006.
5. F. Täger: Springer Handbook of Lasers and Optics. Springer, Berlin, 2007.
6. K. Sakai - Terahertz Optoelectronics. Springer, Berlin, 2005.

	Supplementary literature	There are no requirements
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	