GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Optoelectronics, PG_00064791		
Field of study	Mechatronics		
Date of commencement of studies	February 2027	Academic year of realisation of subject	2027/2028
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	1	Language of instruction	Polish
Semester of study	2	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Metrology and Electronic Systems Department -> Faculty of Electronics Telecommunications and Informatics -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Marcin Strąkowski	
	Teachers	dr inż. Marcin Strąkowski dr inż. Adam Mazikowski	

Lesson types

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 course "Optoelectronics" is for students of mechanical and mechatronics faculties to study the phenomena of optics, optical systems, optical and electronic systems integration, to learn about the selected optoelectronic elements, the applications of modern optical measurement methods, detection of optical signals, technological processes, and optical acquisition, transmition, and information processing systems.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U13] evaluates the feasibility and potential for utilizing new technical and technological achievements in accomplishing tasks characteristic for the field of study	Characterize selected optoelectronic components and measures their interdependencies, correctly identifies and appropriately selects elements of the optoelectronic path, and is capable of constructing basic optoelectronic systems.	[SU1] Assessment of task fulfilment
[K7_W01] explains and describes, based on general knowledge in the field of scientific disciplines forming the theoretical foundations of Mechatronics, the construction and principles of operation of mechatronic systems, processes and their components, as well as methods and means of their integration	Understand the optical phenomena that form the basis of optical and optoelectronic systems. They analyze the principles of operation and properties of optoelectronic components and select optoelectronic elements for the configuration of an optoelectronic system.	[SW1] Assessment of factual knowledge
[K7_W12] identifies and interprets the main developmental trends and significant new achievements in the field of engineering and technical sciences and disciplines relevant to the course of study	know and is able to utilize the latest solutions in the field of optoelectronic systems, particularly light sources, detectors, and elements of the optical signal transmission path. They possess up-to-date knowledge of contemporary optoelectronic measurement systems.	[SW1] Assessment of factual knowledge

Subject contents

Course content – lecture

1. Optoelectronic system and components
2. Methods of optical radiation description, radiometry, photometry. Radio- and photometric units.
3. Light guiding in an optical system. Light interactions with matter, absorption, transmission and reflection coefficients.
4. Optical scattering phenomena in optical media
5. Boundary effects in light transmission, Fresnel equations
6. The phenomenon of optical interference.
7. Interferometers, filters
8. Fabry-Pérot resonator
9. Applications of interferometry
10. Light sources: thermal, EL, VF, LED
11. Lasers, conditions for the laser beam emission.
12. Properties of the laser beam, types of lasers, applications.
13. Laser diodes, construction, principle of operation, parameters, characteristics, applications
14. Optical detectors, thermal and photon detectors (PMT, PIN, APD, CCD, CMOS), properties, characteristics, applications
15. Work safety with optical systems
16. Optical systems for visualization of information
17. Construction and classification of optical fibers
18. Basic parameters of optical fibers: numerical aperture, acceptance angle, attenuation
19. Optical fiber with a stepwise refractive index profile
20. Dispersion in optical fibers, influence on transmission properties
21. Optical fiber with a gradient refractive index profile
22. Optical transmission of signals
23. Mono-mode optical fiber, its properties
24. Optical reflectometry OTDR
25. Passive optical elements
26. Designing optoelectronic systems
27. New trends and achievements in optoelectronics

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Laboratory exercises	50.0%	40.0%
Tests during the semester	50.0%	60.0%

Recommended reading

Basic literature

1. J. Siuzdak: Systemy i sieci fotoniczne, 2009
2. B. Ziętek: Optoelektronika, 2011
3. G. Einarsson: Podstawy telekomunikacji światłowodowej, 1998
4. BEA Saleh, MC Teich: Fundamentals of Photonics, 2007

Supplementary literature

1. M. Born, E. Wolf: Principles of optics : electromagnetic theory of propagation, interference and diffraction of light, 1999
2. W. Drexler, JG. Fujimoto: Optical Coherence Tomography, 2015
3. S. Kasap: Optoelectronics and Photonics (2nd ed.), 2012
4. A.W. Rogalski, Z. Bielecki: Detekcja sygnałów optycznych, 2020

eResources addresses

Example issues/ example questions/ tasks being completed

1. The principles of the light beam and methods for their characterization.
2. The phenomena of optical interference and its metrological applications.
3. Lights source and their features.
4. Lasers: types, constructions, features, and applications.
5. Optical detectors, their types, constructions, and features.
6. The influence on optical beam propagation of fiber dispersion.
7. Fibers: types, features, and applications

Practical activites within the subject

Not applicable

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