GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Fundamentals of Optics, PG_00048685		
Field of study	Electronics and Telecommunications		
Date of commencement of studies	February 2025	Academic year of realisation of subject	2024/2025
Education level	second-cycle studies	Subject group	Optional subject group Specialty subject group 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	1	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	exam
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	30.0	0.0	0.0	0.0	45
	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	45	6.0	24.0	75

Subject objectives	The aim of the course is to provide knowledge on geometric optics with rights and principles of geometrical optics and the ability to apply that knowledge to the analysis of the optical beam propagation through selected optical elements.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U12] is able, to an increased extent, to analyze the operation of components and systems related to the field of study, as well as to measure their parameters and study their technical characteristics, and to plan and carry out experiments related to the field of study, including computer simulations, interpret the obtained results and draw conclusions	He can determine the ABCD transformation matrix of a complex optical system consisting of many thin, thick or mirror lenses. He can determine the course of rays and the position of cardinal points of gradient lenses. He can determine the stability conditions of periodic optical systems consisting of mirrors or lenses.	[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 the Seidel aberrations and the chromatic aberration of optical systems, knows the principle of operation of aspherical lenses, knows systems using aspherical mirrors.	[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 laws and principles of geometrical optics, knows ABCD transformation matrix and cardinal points of optical system in the paraxial approximation, knows the concept of optical rays and methods of calculating the directions of radiation after reflection or refraction in optical elements in the paraxial approximation and when this approximation can not be used.	[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 analyze the course of rays in free space in the presence of reflecting or breaking elements. He can determine the location of cardinal points of a complex optical system based on knowledge of the ABCD transformation matrix. He can determine the course of rays and image position in the optical system, using the location of cardinal points of the system.	[SU1] Assessment of task fulfilment

Subject contents

1. Introduction, historical background.
2. Ray optics Huygens and Fermat's principles.
3. Reflection law and Snell's law as applications of Huygens and Fermat's principles.
4. Description of light propagation in free space or in optical elements by optical rays.
5. Monte Carlo methods based on ray optics.
6. Paraxial rays.
7. Ray-transfer matrices of simple optical components.
8. Cardinal points of optical system: focal points, principal points, and nodal points.
9. Relationships between ray-transfer matrix elements and cardinal points
10. Chromatic aberration: transverse or lateral axial chromatic aberration, magnification chromatic aberration.
11. Seidel's five aberrations: spherical aberration, astigmatism, curvature of field, coma, and distortion.
12. Methods of compensation of aberrations achromatic or apochromatic doublets, special lens systems.
13. Aspherical elements aspherical lenses, parabolic, elliptical, or hyperbolic mirrors.
14. Examples of complex optical systems using aspherical elements: Newton, Cassegrain, and Gregorian telescopes, Schmidt camera.

Prerequisites and co-requisites

No requirements

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Midterm colloquium	50.0%	40.0%
Written exam	50.0%	60.0%

Recommended reading

Basic literature	1. J. K. Jabczyński: Podstawy optyki stosowanej. WAT, Warszawa, 2006. 2. B. E. A. Saleh, M. C. Teich: Fundamentals of Photonics, 2nd Edition. John Wiley & Sons, New York, 2007. 3. F. L. Pedrotti, L. S. Pedrotti: Introduction to Optics. Prentice-Hall International, Inc., New York, 1997. 4. E. Hecht: Optics, 4th Edition. Addison Wesley, New York, 2001. 5. I. M. Sobol: Primer for the Monte Carlo Method. CRC Press, Boca Raton, 1994.
Supplementary literature	No requirements
eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed	
Work placement	Not applicable

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