

## § GDAŃSK UNIVERSITY § OF TECHNOLOGY

## Subject card

Subject name and code	Electromagnetic Fields and Waves, PG_00047910								
Field of study	Electronics and Telecommunications								
Date of commencement of studies	October 2024		Academic year of realisation of subject			2025/2026			
Education level	first-cycle studies		Subject group			Obligatory subject group in the field of study			
Mode of study	Full-time studies		Mode of delivery			at the university			
Year of study	2		Language of instruction			Polish			
Semester of study	3		ECTS credits			2.0			
Learning profile	general academic profile		Assessment form			assessment			
Conducting unit	Department of Microw Informatics	na Engineering -> Faculty of Electronics, Telecommunications and							
Name and surname	Subject supervisor		dr hab. inż. Piotr Kowalczyk						
of lecturer (lecturers)	Teachers		dr hab. inż. Piotr Kowalczyk						
Lesson types and methods	Lesson type	Lecture	Tutorial	Laboratory	Projec	t	Seminar	SUM	
of instruction	Number of study hours	15.0	15.0	0.0	0.0		0.0	30	
	E-learning hours inclu	ided: 0.0							
Learning activity and number of study hours	Learning activity	Participation in classes includ plan	ed in study Participation in consultation hou		n Iours	Self-study		SUM	
	Number of study hours	30		2.0		18.0		50	
Subject objectives	Presentation of the basic phenomena relating to plane wave propagation, antenna theory and wave propagation in waveguiding structures.								
Learning outcomes	Course outcome		Subject outcome			Method of verification			
	[K6_W03] Knows and understands, to an advanced 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		Student has mastered the structure and principle of operation of such components using electromagnetic wave propagation as antennas, basic waveguiding structures (coaxial lines, rectangular waveguide, microstrip line) and fibers.			[SW1] Assessment of factual knowledge			
	[K6_W02] knows and understands, to an advanced extent, selected laws of physics and physical phenomena as well as methods and theories explaining the complex relationships between them, constituting the basic general knowledge in the field of technical sciences related to the field of study [K6_U02] can perform tasks related to the field of study in an innovative way as well as solve complex and nontypical problems, applying knowledge of physics, in changing and not fully predictable conditions		Student has mastered the theory of electromagnetic wave propagation in free space, unbounded lossy and anisotropic materials, at the boundary between different materials as well as in weveguiding structures. Student has the skills in calculation: the parameters of plane wave in free space, in unbounded lossy media,during incidence at the boundary between different materials, the parameters of electromagnetic waves in waveguiding structures and can determine the parameters of waveguiding structures.			[SW1] Assessment of factual knowledge [SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment			

Subject contents	1. Plane wave in free space: polarization, phase velocity, group velocity, Poynting vector.							
	2. Plane wave in lossy medium: propagation constant, penetration depth, dispersion.							
	3. Em propagation in anisotropic medium, Faraday rotation effect.							
	4. Normail incidence of em wave: reflection and transmission coefficients, standing wave, VSWR.							
	5. Oblique incidence of em wave, Fresnel's formulas.							
	6. Total reflection and Brewster angles.							
	7. Inhomogeneous Maxwell's equations, retarded electromagnetic potentials.							
	8. Hertz dipole, far and near field regions, radiation resistance.							
	9. Waveguiding structures: TEM, TE, TM waves.							
	10. Coaxial line, higher order modes.							
	11. Microstrip line.							
	12. Rectangular waveguide, higher order modes.							
	13. Parallel plate transimission line. Waveguiding structures and transmission line equation.							
Prerequisites								
and co-requisites	l		1					
Assessment methods	Subject passing criteria	Passing threshold	Percentage of the final grade					
	midterm tests and colloquia	50.0%	100.0%					
Recommended reading		<ol> <li>W. Zichildycz, Presentation to the locate, web page of Rimix.</li> <li>T. Morawski, W. Gwarek: Teoria Pola Elektromagnetycznego (Pola i Fale Elektromagnetyczne), WNT, Warszawa, 1998.</li> <li>P. Kowalczyk, R. Lech, W. Zieniutycz: Podstawy elektromagnetyzmu w zadaniach,</li> <li>David J. Griffiths: Podstawy elektrodynamiki, PWN, Warszawa, 2001.</li> </ol>						
	Supplementary literature         D. K. Cheng: Fields and waves Electromagnetics, Addison-Wesley           Publishing Company, 1983         Publishing Company, 1983							
	eResources addresses	Adresy na platformie eNauczanie:						

Example issues/ example questions/ tasks being completed	<ol> <li>Formulate the conditions for circular polarization for a plane wave.</li> <li>Calculate the propagation constant of a plane wave in a good conductor.</li> </ol>
	3. Discuss the effect of Faraday rotation.
	4. Discuss the properties of the em field close to Hertz dipole (near field).
	5. Calculate the single mode operating band of air coaxial line with specified dimensions.
Work placement	Not applicable