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 2025	Academic year of realisation of subject	2026/2027
Education level	first-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	Polish
Semester of study	3	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department Of Microwave And Antenna Engineering -> Faculty Of Electronics Telecommunications And Informatics -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Piotr Kowalczyk	
	Teachers	dr hab. inż. Piotr Kowalczyk	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	15.0	0.0	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	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_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 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.	[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools
[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	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.	[SW1] Assessment of factual knowledge
[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

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	

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
midterm tests and colloquia	50.0%	100.0%

Recommended reading

Basic literature	1. W. Zieniutycz: Presentation to the lecture, web page of KIMiA. 2. T. Morawski, W. Gwarek: Teoria Pola Elektromagnetycznego (Pola i Fale Elektromagnetyczne), WNT,Warszawa, 1998. 3. P. Kowalczyk, R. Lech, W. Zieniutycz: Podstawy elektromagnetyzmu w zadaniach, 4. David J. Griffiths: Podstawy elektrodynamiki, PWN, Warszawa, 2001.
Supplementary literature	D. K. Cheng: Fields and waves Electromagnetics, Addison-Wesley Publishing Company, 1983
eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed	1. Formulate the conditions for circular polarization for a plane wave. 2. Calculate the propagation constant of a plane wave in a good conductor. 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

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