GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Electrodynamics, PG_00047680		
Field of study	Electronics and Telecommunications		
Date of commencement of studies	October 2023	Academic year of realisation of subject	2023/2024
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	1	Language of instruction	Polish
Semester of study	2	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Microwave and Antenna Engineering -> Faculty of Electronics, Telecommunications and Informatics		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Piotr Kowalczyk	
	Teachers	dr hab. inż. Piotr Kowalczyk dr hab. inż. Rafał Lech	

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	3.0	42.0	75

Subject objectives

Presentation of the basic phenomena relating to electrostatic fields, magnetostatic fields and electromagnetic fields taking place in a free space and different media.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[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	The student knows the laws of electrodynamics, properties of fields in the interface between different media, power balance and electromagnetic waves properties.	[SW1] Assessment of factual knowledge
[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 is able to study the properties of static and electromagnetic fields in various coordinate systems, determine the fields in the interface between different media, calculate the power balance.	[SU4] Assessment of ability to use methods and tools

Subject contents	1. Mathematical field theory, flux, circulation, curl, divergence, gradient. 2. Spherical and cylindrical coordinate systems. 3. Electrical and magnetical fields, Coulomb's and Lorentz's force laws. 4. Continuous media concept, charge and current densities, charge continuity equation. 5. Maxwell's equations in free space - integral form. 6. Physical interpretation of Maxwell equations. 7.Maxwell's equations in free space - differentia form and formulation for complex amplitudes. 8. Media - classification. Electrical permittivity, magnetic permeability, relaxation time, dielectrics and conductors, Ohm's law. 9. Maxwell's equations in media. 10. Boundaruy conditions for electric and magnetic fields. Magnetic circuits, electric shielding. 11. Continuity equation for electromagnetic energy - Poynting vector. 12. Maxwell's equations for static case - electrostatic, concept of potential, voltage. 13. Laplace 's and Poisson's equations. 14. Magnetostatics Amppere's and Biot-Savart's laws. Vector potential. 15. Plane wave as a solution of Maxwell's equation in free space, parameters of wave motion. 16. Final test.
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, skrypt PG 2007. 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: Podstawy Elektrodynamiki 23/24 - Moodle ID: 36742 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=36742
Example issues/ example questions/ tasks being completed	1. Formulate (in integral form) and discuss Faraday's law of induction. 2. Formulate equation (in integral form) and discuss the continuity equation. 3. Formulate a definition of electric induction vector in the material, in which the electric polarization effects occure. 4. Formulate the boundary conditions at the surface of an ideal conductor. 5. Introduce the concept of the complex dielectric permittivity starting from Ampere's circuital law for complex amplitudes.
Work placement	Not applicable