GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Fundamentals of electrodynamics, PG_00058340		
Field of study	Hydrogen Technologies and Electromobility		
Date of commencement of studies	October 2022	Academic year of realisation of subject	2022/2023
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	1	Language of instruction	Polish
Semester of study	2	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Katedra Elektrotechniki i Inżynierii Wysokich Napięć -> Faculty of Electrical and Control Engineering		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Adam Młyński	
	Teachers	dr inż. Adam Młyński	

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

Familiarizing students with the phenomena occurring in the electromagnetic field and methods of their description.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W02] has basic knowledge of physics and chemistry including electrostatics, electromagnetism, electrodynamics, wave motion, acoustics, mechanics, thermodynamics, optics, solid state physics; including knowledge necessary to understand the basic physical phenomena occurring in hydrogen devices, systems and installations as well as automation and robotics systems	Student knows the ways of describing and analyzing electric and magnetic fields, he can describe the phenomena occurring in the electric and magnetic fields.	[SW3] Assessment of knowledge contained in written work and projects
[K6_K04] can react in abnormal and emergency situations, threats to health and life when using automation and robotics components and systems in hydrogen devices and installations	The student is able to determine and assess the exposure to the human body and the environment from the electromagnetic field	[SK5] Assessment of ability to solve problems that arise in practice
[K6_U04] can apply the learned methods to the analysis and design of electrical elements, devices and systems	Student is able to calculate the parameters of electrical systems (resistance, inductance, capacitance), electrodynamic forces, induced voltages.	[SU3] Assessment of ability to use knowledge gained from the subject
[K6_W03] knows the basic methods of analysis of DC and AC circuits, the basic laws of electrical engineering and the properties of elements of electrical circuits	Student knows and understands the concepts of: electric voltage, electric current, resistance, self and mutual inductance, electric capacitance, inducing of voltages	[SW3] Assessment of knowledge contained in written work and projects

Subject contents	Electrostatics: Coulomb's law, quantities describing the electric field, Gauss's law, Maxwell's laws for electrostatics, electrostatic properties of the environment, electric capacity. Electric field in a conductive environment: quantities describing the electric field, Maxwell's laws in a conductive environment, electrical properties of the environment, resistance of conductors and earthing. Magnetostatics: Ampere's law, quantities describing the magnetic field, Biot's Savarte's law, Maxwell's laws for magnetostatics, self and mutual inductance, magnetic properties of the environment, magnetic circuits, electrodynamic forces. Faraday's law.
Prerequisites and co-requisites	Knowledge of vector calculus. Ability to calculate derivatives of functions of many variables. Knowledge of the concept of linear, surface and volume integrals.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Written exam	55.0%	70.0%
Tests during the semester	55.0%	30.0%

Recommended reading

Basic literature	1. Zahn M.: Pole elektromagnetyczne. PWN Warszawa 1989 2. Griffiths D.J.: Podstawy elektrodynamiki. PWN Warszawa 2001 3. Krakowski M**:** Elektrotechnika teoretyczna, tom 2. Pole elektromagnetyczne. PWN, Warszawa 1980 4. Piątek Z., Jabłoński P.: Podstawy teorii pola elektromagnetycznego. WNT, Warszawa 2010 5. Sikora R.: Teoria Pola Elektromagnetycznego. WNT, Warszawa 1997 6. Sikora J., Skoczylas J., Sroka J., Wincenciak S.: Zbiór zadań z teorii pola elektromagnetycznego. Oficyna Wyd. Politechniki Warszawskiej. Warszawa 2004
Supplementary literature	1. Feynman R.P., Leighton R.B., Sands M.: Feynmana wykłady z fizyki (tom II). PWN Warszawa 2001 2. Kurdziel R.: Podstawy elektrotechniki. WNT, Warszawa 1965 3. Rawa H.: Podstawy elektromagnetyzmu. Wydawnictwo Politechniki Warszawskiej
eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed	1. Calculate the distribution of the electric field intensity from the given system of point charges. 2. What condition should the dimensions of the coaxial cable meet so that the maximum electric field intensity in the cable is minimal. 3. Calculate the capacitance of a single-core, coaxial cable of length l, whose core diameter is d, the inner diameter of the shield D, and the relative permittivity of the dielectric is e, 4. Calculate the leakage rate of a coaxial cable of length l, whose core diameter is d, the inner diameter of the shield D, and the insulation conductivity is s. 5. Calculate the self-inductance per unit length of a two-wire line with wires of diameter d separated by a distance h.
Work placement	Not applicable