



Subject card

Subject name and code	Mathematical modeling in electrodynamics , PG_00050025						
Field of study	Electrical Engineering						
Date of commencement of studies	October 2025	Academic year of realisation of subject				2025/2026	
Education level	second-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	Part-time studies	Mode of delivery				at the university	
Year of study	1	Language of instruction				Polish	
Semester of study	1	ECTS credits				4.0	
Learning profile	general academic profile	Assessment form				assessment	
Conducting unit	Department of Control Systems Engineering -> Faculty Of Electrical And Control Engineering -> Wydział Politechniki Gdańskiej						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Mirosław Wołoszyn					
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	20.0	0.0	20.0	0.0	0.0	40
	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	40		10.0		50.0	100
Subject objectives	Advanced knowledge of electrodynamics problems and method of solving ordinary and partial differential equations.						
Learning outcomes	Course outcome		Subject outcome			Method of verification	
	[K7_U05] is able to select equipment and carry out electrical measurements, design measuring systems for the determination of nonelectrical quantities, and analyse the results obtained		can write a computer program that solves ordinary and partial differential equations			[SU4] Assessment of ability to use methods and tools	
	[K7_U06] is able to analyse, model, simulate and design electrical systems		can solve technical electrodynamics problems using the analytical and numerical methods			[SU4] Assessment of ability to use methods and tools	
	[K7_W01] has an extended and deepened knowledge of mathematics, including selected issues of numerical methods and knowledge useful for solving tasks in the field of electrotechnology and electrodynamics, has a general knowledge of technical sciences covering their fundamentals and applications		Has in-depth knowledge of numerical methods, knows numerical methods for solving ordinary and partial differential equations. Has advanced knowledge of electrodynamics, can formulate a problem using Laplace and Poisson equation, can put boundary conditions.			[SW3] Assessment of knowledge contained in written work and projects	
Subject contents	Euler's, Adams Bashforth's method, Adams Moulton's method, 4th order Runge-Kutta, Merson's method, finite difference method, basics of finite element method, Maxwell's equations. Solving problems in electrostatics, magnetostatics and electromagnetic fields using the finite difference method and the finite element method (1D and 2D). Poynting's vector. Wave equation. The propagation of waves in material centers. Introduction to the theory of wave systems. Basics of the theory of antenna systems and waveguides (basic features and parameters, zones and radiation conditions, reciprocity principle). : Discussion of integral methods for solving field problems - the method of boundary elements and the method of moments. Basics of electromagnetic compatibility and radiated disturbances.						
Prerequisites and co-requisites	Knowledge of electrodynamics in the scope of this first degree. Basic knowledge of numerical methods						

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
		Tests and work in laboratory	60.0%
Recommended reading	Basic literature	Griffiths D.J.: Podstawy elektrodynamiki. PWN Warszawa 2001 Bolkowski S. i inni: Komputerowe metody analizy pola elektromagnetycznego. WNT Warszawa 1993 Jackson J.D.: Elektrodynamika klasyczna. PWN Warszaw 1982 Leon o. Chua, Pen-Min Lin. Komputerowa Analiza Układów Elektronicznych, WNT, Warszawa 1981	
	Supplementary literature	M. Sadiku. Elements of electromagnetics K. Chari. S. Salon. Numerical methods in electromagnetism	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed	For a given system solve the Laplace or Poisson equation. Check if the vector field has a vector potential. Find the potential distribution in the system. Calculate the vector's magnetic potential in the system. Examine the skin effect and proximity effect. Assign the distribution of the electromagnetic field of the elementary radiating dipoles. Design simple antenna systems.		
Work placement	Not applicable		

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