



Subject card

Subject name and code	Mathematical modeling in electrodynamics , PG_00050025						
Field of study	Electrical Engineering						
Date of commencement of studies	October 2026	Academic year of realisation of subject				2026/2027	
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 Electrical Engineering -> Faculty of Electrical and Control Engineering -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Mirosław Wołoszyn					
	Teachers	dr inż. Krzysztof Łuksza dr hab. inż. Mirosław Wołoszyn					
Lesson types	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	The aim of the course is to familiarise students with advanced problems in electrodynamics and methods for solving ordinary and partial differential equations.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K7_U06] is able to analyse, model, simulate and design electrical systems	The student analyses, models, and conducts simulations.			[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		
	[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	The student creates a computer programme that solves ordinary and partial differential equations. The programme is designed to solve.			[SU4] Assessment of ability to use methods and tools		

Subject contents	<p>Course content – lecture</p> <p>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.</p>		
	<p>Course content – laboratory</p> <p>Application of multi-step methods in solving ordinary differential equations in problems related to transient states in electrical circuits. Solving problems in electrodynamics using the finite difference method and the FEMM simulation programme. Analysis of the transient state of a thermal process in a 1D system.</p>		
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%	100.0%
Recommended reading	Basic literature	<p>Griffiths D.J.: Podstawy elektrodynamiki. PWN Warszawa 2001</p> <p>Bolkowski S. i inni: Komputerowe metody analizy pola elektromagnetycznego. WNT Warszawa 1993</p> <p>Jackson J.D.: Elektrodynamika klasyczna. PWN Warszaw 1982</p> <p>Leon o. Chua, Pen-Min Lin. Komputerowa Analiza Układów Elektronicznych, WNT, Warszawa 1981</p>	
	Supplementary literature	<p>M. Sadiku. Elements of electromagnetics</p> <p>K. Chari. S. Salon. Numerical methods in electromagnetism</p>	
	eResources addresses		
Example issues/ example questions/ tasks being completed	Solve Laplace's or Poisson's equation for a given system. Check whether the given vector field has a vector potential. Determine the potential distribution in the system. Calculate the vector magnetic potential in the system. Investigate the phenomena of skin effect and proximity effect.		
Practical activities within the subject	Not applicable		

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