GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Mathematical modeling in electrodynamics , PG_00050025		
Field of study	Electrical Engineering		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2024/2025
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		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Mirosław Wołoszyn	
	Teachers	dr hab. inż. Mirosław Wołoszyn mgr inż. Krzysztof Łuksza	

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_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_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_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

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

<table>
<tr><td>Assessment methods and criteria</td><td colspan="2"><table><tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr><tr><td>Tests and work in laboratory</td><td>60.0%</td><td>100.0%</td></tr></table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>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</td></tr>
<tr><td>Supplementary literature</td><td>M. Sadiku. Elements of electromagnetics

K. Chari. S. Salon. Numerical methods in electromagnetism</td></tr>
<tr><td>eResources addresses</td><td>Adresy na platformie eNauczanie:
MODELOWANIE MATEMATYCZNE W ELEKTRODYNAMICE [ET] [Niestacjonarne][2024/25] - Moodle ID: 39873
https://enauczanie.pg.edu.pl/moodle/course/view.php?id=39873</td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="2">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 abd proximity effect. Assign the distribution of the electromagnetic field of the elementary radiating dipoles. Design simple antenna systems.</td></tr>
<tr><td>Work placement</td><td colspan="2">Not applicable</td></tr>
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