GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Mathematical modeling in electrodynamics , PG_00065789		
Field of study	Electrical Engineering		
Date of commencement of studies	February 2027	Academic year of realisation of subject	2026/2027
Education level	second-cycle studies	Subject group	
Mode of study	Full-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	prof. dr hab. inż. Mirosław Wołoszyn	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	20.0	0.0	30.0	0.0	0.0	50

E-learning hours included: 0.0

eNauczanie source address: https://enauczanie.pg.edu.pl/2025/course/view.php?id=3700

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	50	5.0	45.0	100

Subject objectives

The aim of the course is to learn 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	Student analyzes, models, conducts simulations.	[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	Student creates a computer program to solve ordinary and partial differential equations.	[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	Student has in-depth knowledge of numerical methods, knows numerical methods for solving ordinary and partial differential equations. Has advanced knowledge of electrodynamics, is able to formulate a problem using Laplace and Poisson equations, is able to set boundary conditions. Has in-depth knowledge of electrodynamics, knows numerical methods for solving ordinary and partial differential equations.	[SW3] Assessment of knowledge contained in written work and projects

<table>
<tr><td>Subject contents</td><td>Course content – lecture

Euler's method, Adams Bashforth method, Adams Moulton method, 4th order Runge-Kutty method, Merson's method, finite difference method, basics of finite element method, Application of Maxwell's equations. Solution of electrostatics, magnetostatics and electromagnetic fields by finite difference method and finite element method (1D and 2D). Poynting vector. Wave equation. Wave propagation in material media. Introduction to the theory of wave systems.

Course content – laboratory

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.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Knowledge of electrodynamics from undergraduate studies. Basic knowledge of numerical methods.</td></tr>
<tr><td>Assessment methods and criteria</td><td><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Tests and lab work</td><td>60.0%</td><td>100.0%</td></tr>
</table></td></tr>
<tr><td>Recommended reading</td><td><table>
<tr><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></td></tr>
</table></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>Solve the Laplace or Poisson equation for a given system. Verify that a given vector field has a vector potential. Determine the potential distribution in the system. Calculate the vector magnetic potential in a system. Investigate the phenomenon of skin and proximity.</td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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