University of Gdańsk

Subject card

Subject name and code	Equations of Mathematical Physics, PG_00182321						
Field of study	Physics						
Date of commencement of studies	October 2025		Academic year of realisation of subject	2025/2026			
Education level	Master's 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	English			
Semester of study	1		ECTS credits	5.0			
Learning profile	academic		Assessment form	credit			
Conducting unit	Division of Mathematical Methods of Physics -> Institute of Theoretical Physics and Astrophysics -> Faculty of Mathematics, Physics and Informatics -> Rector						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. Marcin Marciniak				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	30.0	0.0	0.0	0.0	60
	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	60		0.0		65.0	125
Subject objectives	This course describes the fundamental types of second-order linear partial differential equations (often called the equations of mathematical physics), covering their properties and methods for solving them.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[FIZMU2_W02] has in-depth knowledge in mathematics as well as mathematical and computational methods, necessary to solve physical problems of high complexity and in-depth in the selected area of physics	The student knows: the classification of second-order linear partial differential equations, the properties of hyperbolic equations, using the wave equation as an example, Kirchhoff's formula, the d'Alembert method, and the Fourier method for solving the string equation, the method for solving the equation of a semi-infinite string, the properties of elliptic equations, using Laplace's equation as an example, the Green's function method for solving the Dirichlet problem, the properties of parabolic equations, using the heat equation as an example, the Fourier transform method.	[SW4] test/exam - oral or written
[FIZMU2_U04] can find the necessary information in professional literature, both in databases and in other sources; can reconstruct the reasoning or the course of an experiment described in the literature, taking into account the assumptions and approximations made	The student can locate information regarding methods for solving differential equations in literature and online sources.	[SU2] presentation/project/paper/ report
[FIZMU2_U03] is able to make a critical analysis of the results of measurements, observations or theoretical calculations along with the assessment of the accuracy of the results	The student can determine approximate solutions to differential equations.	[SU5] implementation of a problem task

Subject contents

Sturm-Liouville Systems

The classification of second-order linear partial differential equations.

Properties of hyperbolic equations using the wave equation as an example; Kirchhoff's formula, the d'Alembert method, and the Fourier method for solving the string equation; the method for solving the equation of a semi-infinite string.

Properties of elliptic equations using Laplace's equation as an example; the Green's function method for solving the Dirichlet problem.

Properties of parabolic equations using the heat equation as an example; the Fourier transform method.

Prerequisites and co-requisites

Courses completed: Linear Algebra, Mathematical Analysis for Physicists, Mathematical Methods of Physics.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Written exam	51.0%	70.0%
Project	51.0%	30.0%

Recommended reading

Basic literature	A. N. Tikhonov, A. A. Samarskii, Equations of Mathematical Physics, Dover Publications, 2011 V. P. Pikulin, S. I. Pohozaev, Equations of Mathematical Physics. A practical course. Springer Nature, 2001
Supplementary literature	not applicable
eResources addresses	

Example issues/ example questions/ tasks being completed	not applicable
Work placement	Not applicable

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