University of Gdańsk

Subject card

Subject name and code	Equations of Mathematical Physics, PG_00208822		
Field of study	Mathematics		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2026/2027
Education level	Master's studies	Subject group	Obligatory subject group in the field of study Optional subject group
Mode of study	full-time studies	Mode of delivery	at the university
Year of study	2	Language of instruction	Polish
Semester of study	3	ECTS credits	6.0
Learning profile	academic	Assessment form	exam
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	10.0	80.0	150

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
[MATMU2_W02] knows and understands well the role and importance of the construction of mathematical reasoning	The student knows and understands the role of mathematical reasoning in the field of mathematical physics equations.	[SW4] test/exam - oral or written
[MATMU2_K02] is ready to precisely formulate questions to deepen his/her understanding of a given topic or find missing elements of reasoning	The student is ready to formulate precise questions that serve to deepen one's understanding of a given topic or to find missing elements of reasoning in terms of the objectives and scope of the subject.	[SK8] observation of student's independent or team work
[MATMU2_U06] is able to apply methods and examples from a selected field of mathematics in related fields	The student is able to determine approximate solutions of differential equations used in social sciences, medical sciences, biology and chemistry, among others.	[SU5] implementation of a problem task
[MATMU2_K06] is ready to formulate opinions on basic mathematical issues	The student is ready to formulate opinions on basic mathematical issues within the scope of the subject objectives and content.	[SK8] observation of student's independent or team work
[MATMU2_K04] is ready to understand and appreciate the importance of intellectual honesty in one's own and other people's actions; ethical conduct	The student is ready to understand and appreciate the importance of intellectual honesty in one's own and other people's actions; ethical conduct.	[SK8] observation of student's independent or team work
[MATMU2_U03] can understand mathematical texts of various types from selected fields of mathematics	The student is able to read and understand mathematical texts of a diverse nature concerning equations of mathematical physics.	[SU5] implementation of a problem task
[MATMU2_W01] knows and understands in-depth the theory of selected areas of mathematics	The student knows the applications and state of knowledge of the following equations: Laplace, Poisson, wave and heat, as well as selected integral equations.	[SW4] test/exam - oral or written
[MATMU2_K01] is willing to acknowledge the limitations of his or her own knowledge and is willing to pursue further education	The student is willing to acknowledge the limitations of his/her own knowledge and is willing to pursue further education in the subject's objectives and content.	[SK8] observation of student's independent or team work
[MATMU2_U01] can construct mathematical reasoning: prove theorems and refute hypotheses through construction and selection of counterexamples	The student constructs mathematical reasoning in the field of mathematical physics equations.	[SU5] implementation of a problem task
[MATMU2_U05] can perform proofs in a selected field and, if necessary, also use tools from other areas of mathematics	The student is able to determine approximate solutions of differential equations used in social sciences, medical sciences, biology and chemistry, among others.	[SU5] implementation of a problem task
[MATMU2_W03] knows and understands in-depth a selected field of theoretical or applied mathematics and is able to understand the formulations of issues in this field that are still at the research stage and knows the connections of issues in this field with other areas of mathematics	The student knows the applications and state of knowledge of the following equations: Laplace, Poisson, wave and heat, as well as selected integral equations.	[SW4] test/exam - oral or written
[MATMU2_K05] is ready to independently search for information in literature, also in foreign languages	The student can independently search for literature and websites devoted to a mathematical topic of interest (including those in foreign languages).	[SK5] implementation of a problem task
[MATMU2_U04] is able, at an advanced level and including modern mathematics, to apply and present, orally and in writing, methods of at least one selected branch of mathematics	The student is able to determine approximate solutions of differential equations used in social sciences, medical sciences, biology and chemistry, among others.	[SU5] implementation of a problem task

	Course outcome	Subject outcome	Method of verification
	[MATMU2_U07] is able to define his/her interests and develop them; in particular, is able to establish contact with specialists in his/her field, e.g. understand their lectures intended for young mathematicians	The student is able to understand a selected topic in the theory of differential equations and its application in the social sciences, medical sciences, biology or chemistry.	[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			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Observation of the student's attitude	0.0%	0.0%
	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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