

Subject card

Subject name and code	, PG_00155321						
Field of study	Physics						
Date of commencement of studies	October 2024		Academic year of realisation of subject		2024/2025		
Education level	Bachelor's studies		Subject group		Obligatory subject group in the field of study		
Mode of study	full-time studies		Mode of delivery		at the university		
Year of study	1		Language of instruction		Polish not applicable		
Semester of study	2		ECTS credits		2.0		
Learning profile	academic		Assessment form				
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		dr hab. Marcin Marciniak				
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	15.0	0.0	0.0	0.0	30
	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	30		0.0		30.0	60
Subject objectives	Introduction to elementary ordinary differential equations and the basics of probability theory. The goal is to acquire the necessary mathematical skills required to participate in mechanics courses.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[FIZL3_K01] knows the limitations of his own knowledge and understands the need for further education	The student: - understands that equations with separable variables are a very specific case of differential equations, - knows that to understand physical models, they must learn other types of equations beyond those with separable variables.	[SK8] observation of student's independent or team work
	[FIZL3_K02] can precisely formulate problems to deepen understanding of a given topic	The student is able to: - precisely distinguish a differential equation with separable variables from a Bernoulli equation, - thoroughly analyze the properties of a linear equation with variable coefficients, - calculate the expected value and variance of a random variable with any desired level of precision.	[SK8] observation of student's independent or team work
	[FIZL3_U08] can use mathematical apparatus and numerical methods to describe and model physical phenomena and processes	The student: - is able to solve basic types of first-order ordinary differential equations, - can solve higher-order linear ordinary differential equations with constant coefficients, - is capable of calculating and interpreting the expected value and variance of discrete and continuous random variables, - is able to analyze the independence of random variables.	[SU4] test/exam - oral or written
	[FIZL3_U16] can independently plan and implement his own learning	The student: - is able to independently determine the number of first-order ordinary differential equations they should solve to acquire the necessary skills for independently solving such equations.	[SU8] observation of student's independent or team work
	[FIZL3_W04] knows the basic techniques of higher mathematics, including differential and integral calculus of functions of one and many variables, and the basics of algebra to the extent necessary to describe physical phenomena and solve physical problems	The student: - knows the basic types and methods for solving first-order ordinary differential equations: separable variables, equations with a homogeneous function, linear equations, and Bernoulli equations, - is familiar with methods for solving higher-order linear equations with constant coefficients: homogeneous and non-homogeneous (using the method of undetermined coefficients and variation of parameters), - understands the fundamental concepts of probability theory: probability space, random variable, and the basic characteristics of random variables (expected value and variance), - understands the concept of independence of random variables.	[SW4] test/exam - oral or written
	[FIZL3_K08] is able to speak competently on basic problems of physics and its applications	After this short course on differential equations and the basics of probability theory, the student is able to analyze problems in both quantum mechanics and cosmology, as well as issues related to the unification of interactions.	[SK1] oral statement/conversation/discussion

Subject contents	Block 1: Ordinary Differential Equations • Definitions and general theorems • One-dimensional case: linear equations with constant coefficients (variation of parameters, method of undetermined coefficients) • Systems of first-order ordinary differential equations: types of systems Block 2: Elements of Probability Theory • Probability spaces, event independence, conditional probability, theorems on total probability and Bayes' theorem • Random variables and their characteristics: • Discrete and continuous random variables • Distribution of a random variable and cumulative distribution function • Expected value, variance, and moments • Independence of random variables • Limit theorems														
Prerequisites and co-requisites	Basic knowledge of calculus.														
Assessment methods and criteria	<table><tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr><tr><td>Test 2 - linear equations of higher order</td><td>51.0%</td><td>30.0%</td></tr><tr><td>Test 3 - probability calculus</td><td>51.0%</td><td>40.0%</td></tr><tr><td>Test 1 - ordinary equations of 1st order</td><td>51.0%</td><td>30.0%</td></tr></table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Test 2 - linear equations of higher order	51.0%	30.0%	Test 3 - probability calculus	51.0%	40.0%	Test 1 - ordinary equations of 1st order	51.0%	30.0%
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Recommended reading	<table><tr><td>Basic literature</td><td colspan="2">not applicable</td></tr><tr><td>Supplementary literature</td><td colspan="2">A. D. Polyanin, V. F. Zaitsev, Exact solutions for ordinary diffrential equations, Chapman & Hall/CRC 2003</td></tr><tr><td>eResources addresses</td><td colspan="2">Adresy na platformie eNauczanie:</td></tr></table>			Basic literature	not applicable		Supplementary literature	A. D. Polyanin, V. F. Zaitsev, Exact solutions for ordinary diffrential equations, Chapman & Hall/CRC 2003		eResources addresses	Adresy na platformie eNauczanie:				
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Example issues/ example questions/ tasks being completed	not applicable														
Work placement	Not applicable														

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