

Subject card

Subject name and code	Differential Geometry for Physicists, PG_00182567						
Field of study	Physics						
Date of commencement of studies	October 2026	Academic year of realisation of subject			2027/2028		
Education level	Bachelor's studies	Subject group			Obligatory subject group in the field of study Optional subject group 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	2	Language of instruction			Polish		
Semester of study	3	ECTS credits			5.0		
Learning profile	academic	Assessment form			credit		
Conducting unit							
Name and surname of lecturer (lecturers)	Subject supervisor		dr Denis Dobkowski-Ryłko				
	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	The aim of the course is to introduce students to the fundamental concepts and theorems of differential geometry, with particular emphasis on topics relevant to theoretical physics. The course is intended to provide the mathematical preparation necessary for the study of field theory, special and general relativity, as well as to establish a solid foundation for further exploration of modern geometric and physical theories.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[FIZL3_W04] knows the methods 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		Knows and understands the fundamental concepts of differential geometry, such as differentiable manifold, tangent space, vector and tensor fields, bundles, differential forms, connections, and curvature. Understands the role of differential geometry in describing physical phenomena. Possesses knowledge of the applications of geometric tools in modern theoretical physics and mathematics		[SW4] test/exam - oral or written [SW3] text preparation/written work		
	[FIZL3_U01] can use advanced mathematical formalism to define, describe, and solve problems in physics		Is able to use the apparatus of tensor calculus and differential forms in solving physical and mathematical problems. Is able to independently analyze literature that makes use of the language of differential geometry.		[SU3] text preparation/written work [SU4] test/exam - oral or written		

Subject contents	<ul style="list-style-type: none"> • Elements of linear algebra and topology • Differentiable manifolds • Tangent space and tangent bundle • Vector fields and forms • Submanifolds • Vector bundles • Tensor analysis • Lie derivative • Covariant derivative • Theory of connections 		
Prerequisites and co-requisites	Passed exam in Mathematical Analysis for Physicists and Algebra		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Midterm	51.0%	50.0%
	Exam	51.0%	50.0%
Recommended reading	Basic literature	Foundations of Differential Geometry, Vol. 1, Shoshcichi Kobayashi, Katsumi Nomizu	
	Supplementary literature	J.M. Lee, Manifolds and Differential Geometry, Graduate Studies in Mathematics, vol 107 Visual Differential Geometry and Forms: A Mathematical Drama in Five Acts, T. Needham	
	eResources addresses		
Example issues/ example questions/ tasks being completed			
Work placement	Not applicable		

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