GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Differential geometry, PG_00021513		
Field of study	Mathematics		
Date of commencement of studies	October 2023	Academic year of realisation of subject	2024/2025
Education level	second-cycle studies	Subject group	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	4.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Divison of Nonlinear Analysis -> Institute of Applied Mathematics -> Faculty of Applied Physics and Mathematics		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. Marek Izydorek	
	Teachers	prof. dr hab. Marek Izydorek	

Lesson types and methods of instruction

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	5.0	60.0	125

Subject objectives

The purpose of the lecture is to introduce basic notions of differential geometry.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W04] Has enhanced knowledge of a selected branch of mathematics, theoretical or applied.	The student knows the basic concepts and theorems of differential geometry. He/she knows what geodesic and Gaussian curvature is. He/she can formulate the Egregium Theorem and sketch its proof.	[SW1] Assessment of factual knowledge
[K7_U04] Is familiar with the methods of solving classical ordinary and partial differential equations, is able to apply them in typical practical problems.	The student deepens his or her knowledge of topology, geometry, mathematical analysis and linear algebra.	[SU2] Assessment of ability to analyse information
[K7_U03] Freely uses the tools of analysis, including differential and integral calculus (in particular, the curvilinear and surface integrals), elements of complex and Fourier analysis.	The student is able to characterize the geometry of a Riemann manifold and give its basic topological properties.	[SU3] Assessment of ability to use knowledge gained from the subject
[K7_W05] Has enhanced knowledge of a selected branch of mathematics: knows most classical definitions and theorems and their proofs, Understands problems being examined, Knows relations between problems from particular field with other branches of mathematics, theoretical and applied	The student has an in-depth knowledge of geometry and topology as well as differential and integral calculus. Knows and is able to present and apply advanced methods of modern differential geometry. He/she knows the important theorems of this theory.	[SW1] Assessment of factual knowledge

<table>
<tr><td>Subject contents</td><td>Plane curves. Curves in three-dimensional space. Parameterization of a curve. The arc length parameter. The Frenet frame. The curvature of a curve. Surfaces in three-dimensional space. Local coordinates. The normal to a surface and the tangent plane of a surface. Vector fields on a surface. The first and the second fundamental form of a surface. Curves on a surface. The normal curvature of a surface. The Gauss curvature. The Christoffel symbols. The Weingarten equations. The Gauss theorem. The covariant derivative. Geodesics. The Gauss-Bonnet theorem. Smooth manifolds. Submanifolds in the Euclidean space. The tangent space and the tangent bundle. The Riemann theorem.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Mathematical analysis I-III. Topology. Linear algebra.</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>Written exam</td><td>60.0%</td><td>100.0%</td></tr>
</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>1. J. Oprea, Differential geometry and its applications, Classroom Resource Materials Series, Mathematical Association of America, Washington, 2007. 2. A . Goetz, Geometria różniczkowa (Differential geometry), PWN, Warszawa, 1965 (in Polish).</td></tr>
<tr><td>Supplementary literature</td><td>No recommendations</td></tr>
<tr><td>eResources addresses</td><td>Adresy na platformie eNauczanie:</td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>1. Find the curvature and torsion of a hyperbolic helix. 2. Find the shape operator for the saddle surface z=xy. 3. Show that a geodesic has constant speed.</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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