



Subject card

Subject name and code	Introduction to theory of relativity, PG_00071150						
Field of study	Technical Physics, Mathematics, Nanotechnology, Nanotechnology						
Date of commencement of studies	October 2024	Academic year of realisation of subject			2025/2026		
Education level	second-cycle studies	Subject group			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	4	ECTS credits			1.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Division of Theoretical Physics and Quantum Informaton -> Institute of Physics and Applied Computer Science -> Faculty of Applied Physics and Mathematics -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		prof. dr hab. Marek Czachor				
	Teachers		prof. dr hab. Marek Czachor				
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	0.0	0.0	0.0	15
	E-learning hours included: 0.0						
eNauczanie source address: https://enauczanie.pg.edu.pl/2025/course/view.php?id=5247							
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	15		2.0		8.0	25
Subject objectives	Introduction to the basic ideas of special and general relativity (the idea of space-time, paradoxes, relativity of time, Lorentz transformations, spinors, curved geometry).						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K7_U101] is able to formulate complex research problems and adopts appropriate methods, obtaining innovative solutions, cooperating with other people, both as a leader and a team member	The student is able to formulate the basic paradoxes of the theory of relativity and knows how to interpret them.			[SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject		
	[K7_K101] acknowledges the importance of knowledge related to the field of study in solving cognitive and practical problems, critically assessing the information obtained	The student is able to give examples of the practical use of relativistic structures and indicate their specific physical and engineering applications.			[SK5] Assessment of ability to solve problems that arise in practice		
	[K7_W101] is able to make an in-depth identification of key objects and phenomena related to the field of study, as well as theories that describe them and applicable analytical and design methods	The student understands the basic formal and logical structures of the theory of relativity.			[SW1] Assessment of factual knowledge		

Subject contents	<p>Course content – lecture Space-time as a set of events</p> <p>Coordinate systems and their changes (Lorentz group)</p> <p>Simultaneity and its relativity (train paradox)</p> <p>Proper time (twin paradox). The problem of the passage of time.</p> <p>Light cone and causality (why we always see the past)</p> <p>Adding velocities (i.e., why $v+c=c$)</p> <p>Dimensions: 1+1 and 1+3</p> <p>Energy-momentum four-vector and mass (what $E=mc^2$ means)</p> <p>Stereographic projection and spinors</p> <p>Spinor as a square root of a vector</p> <p>Curvature of space-time, event horizons, and black holes</p> <p>Motion along a geodesic instead of Newton's equation</p> <p>General relativity and GPS location accuracy</p> <p>Dark energy: the ether of the 21st century?</p>											
Prerequisites and co-requisites	Basic knowledge at the level of the second year of studies at a technical university.											
Assessment methods and criteria	<table border="1" data-bbox="451 819 1487 920"> <thead> <tr> <th data-bbox="451 819 798 853">Subject passing criteria</th> <th data-bbox="805 819 1141 853">Passing threshold</th> <th data-bbox="1149 819 1487 853">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="451 853 798 887">Attendance at lectures</td> <td data-bbox="805 853 1141 887">70.0%</td> <td data-bbox="1149 853 1487 887">80.0%</td> </tr> <tr> <td data-bbox="451 887 798 920">Participation in discussions</td> <td data-bbox="805 887 1141 920">20.0%</td> <td data-bbox="1149 887 1487 920">20.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Attendance at lectures	70.0%	80.0%	Participation in discussions	20.0%	20.0%
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Example issues/ example questions/ tasks being completed	<p>The train paradox and the observability of relativity of simultaneity</p> <p>Spinors and four-vectors</p> <p>What type of relativistic object is the electromagnetic field?</p>											
Practical activities within the subject	Not applicable											

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