



## Subject card

Subject name and code	Mathematical methods in transport, PG_00062421						
Field of study	Transport						
Date of commencement of studies	February 2026		Academic year of realisation of subject		2025/2026		
Education level	second-cycle studies		Subject group		Obligatory subject group in the field of study 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	1		Language of instruction		Polish		
Semester of study	1		ECTS credits		4.0		
Learning profile	general academic profile		Assessment form		exam		
Conducting unit	Department of Transportation Engineering -> Faculty of Civil and Environmental Engineering -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr Anita Milewska				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	15.0	15.0	0.0	0.0	45
	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	45		15.0		40.0	100
Subject objectives	Ability to describe the motion of an object in time and space by vectors and issues related to this motion. Analysis of harmonic signals and vibrating systems occurring in issues related to transport. The ability to analyze measurement data and inference in various aspects of transport.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K7_K01] recognizes the importance of knowledge related to the field of study in solving cognitive and practical problems		The student knows the methods used to solve optimization problems, can formulate mathematical models describing issues related to transport.		[SK4] Assessment of communication skills, including language correctness		
	[K7_W04] analyzes complex problems in-depth based on reliable data and properly selected methods, obtaining logical solutions		The student is able to use methods to solve problems optimization, the student can find a solution to a mathematical model describing issues related to transport.		[SW3] Assessment of knowledge contained in written work and projects [SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge		
	[K7_U01] creates innovative solutions to complex and unstructured problems, taking into account the variability of the environment by synthesizing information from many sources, using analytical, simulation and experimental methods		The student creates innovative solutions to complex problems occurring in transport, using appropriately selected methods. The student is able to properly plan an experiment to obtain the necessary data.		[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment		
	[K7_W03] demonstrates in-depth preparation in the application of analytical methods and techniques for formulating and solving problems		The student is able to apply appropriate analytical methods to transport issues, is able to interpret and verify the correctness of the results obtained from the analysis.		[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects		

Subject contents	Course content – lecture Motion of point in space - vector description, velocity vector, acceleration vector, curvature of the trajectory of motion, curvature circle, Frenet trihedral, Frenet formulas. Approximation of measurement data and inference regarding issues occurring in transport. Weibull distribution in transport problems and determination of its parameters from the sample. Moving average and weighted moving average. Multiple regression, linear regression, stepwise regression analysis. Correlation matrix, coefficient of determination, correlation and consistency. Fourier transform and its application to problems related to transport. Signals, signal filtering, harmonic signals and their application in vibrating systems occurring in issues related to transport.		
Prerequisites and co-requisites	Knowledge of vector calculus, mathematical analysis, differential equations, probability and mathematical statistics.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	exam	55.0%	34.0%
	colloquium (issues from exercises and lectures)	55.0%	33.0%
	passing the laboratory	60.0%	33.0%
Recommended reading	Basic literature	Szabatin J., "Podstawy teorii sygnałów", WKŁ (different editions)  Mieloszyk E., "Nieklasyczny rachunek operatorów w zastosowaniu do uogólnionych układów dynamicznych", Wyd. IMP PAN, Gdańsk 2008  Trajdos T., "Matematyka, cz. 3", WNT (different editions)	
	Supplementary literature	Milewska A., Żukowska J., "Testing the Weibull distribution in road traffic losses analysis", Journal of KONBiN, 2008	
	eResources addresses		
Example issues/ example questions/ tasks being completed	1. Approximate the parabola measuring data - take into account different cases of the parabola equation.  2. Present and justify the example of the system generating harmonic signals, occurring in transport.		
Practical activities within the subject	Not applicable		

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