GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Mathematical methods in transport, PG_00062421		
Field of study	Transport		
Date of commencement of studies	February 2027	Academic year of realisation of subject	2026/2027
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_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
[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

<table>
<tr><td>Subject contents</td><td>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. Signals, signal filtering, harmonic signals and their application in vibrating systems occurring in issues related to transport.

Course content – exercises

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. Signals, signal filtering, harmonic signals and their application in vibrating systems occurring in issues related to transport.

Course content – laboratory

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.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Knowledge of vector calculus, mathematical analysis, differential equations, probability and mathematical statistics.</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>exam</td><td>55.0%</td><td>34.0%</td></tr>
<tr><td>colloquium (issues from exercises and lectures)</td><td>55.0%</td><td>33.0%</td></tr>
<tr><td>passing the laboratory</td><td>60.0%</td><td>33.0%</td></tr>
</table>
</td></tr>
<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>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)</td></tr>
<tr><td>Supplementary literature</td><td>Milewska A., Żukowska J., "Testing the Weibull distribution in road traffic losses analysis", Journal of KONBiN, 2008</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
</table>
</td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>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.</td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
</table>

Document generated electronically. Does not require a seal or signature.