



## Subject card

Subject name and code	Linear algebra, PG_00045352						
Field of study	Data Engineering, Data Engineering						
Date of commencement of studies	October 2026	Academic year of realisation of subject			2026/2027		
Education level	first-cycle studies	Subject group			Obligatory subject group in the field of study		
Mode of study	Full-time studies	Mode of delivery			at the university		
Year of study	1	Language of instruction			English		
Semester of study	1	ECTS credits			3.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Faculty of Electronics Telecommunications and Informatics -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	dr Ewa Kozłowska-Walania					
	Teachers	dr Ewa Kozłowska-Walania					
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	15.0	0.0	0.0	0.0	30
	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	30		5.0		40.0	75
Subject objectives	Students obtain competence in using methods of linear algebra and knowledge how to solve simple problems that are found in the field of engineering, in particular connected to data engineering.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K6_W02] demonstrates advanced preparation in methods and techniques for formulating and solving problems	Student knows the main theorems, methods and tools presented during the lecture and knows how to use them.			[SW1] Assessment of factual knowledge		
	[K6_U04] formulates logical solutions to complex or unstructured problems	Student is able to analyze a problem and choose, from the methods presented during the class, the tools necessary for its correct solution.			[SU5] Assessment of ability to present the results of task [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		

Subject contents	Course content – lecture		
	<ul style="list-style-type: none"> <li>• Binary operations. Basic algebraic structures: group, ring, field, linear space.</li> <li>• Elements of modular arithmetic, tables of addition and multiplication modulo <math>n</math>. Inverse modulo <math>n</math>. Field <math>\mathbb{Z}_p</math>.</li> <li>• Field of complex numbers. Geometrical interpretation of complex numbers. Complex arithmetic. Complex roots. Simple equations in complex domain.</li> <li>• Ring of polynomials over field <math>K</math>. Roots of polynomials. Fundamental theorem of algebra. Polynomial factorization. Polynomial arithmetic with coefficients from field <math>K = \mathbb{Z}_p</math>. Synthetic division.</li> <li>• Matrices and determinants. Inverse matrix. Matrix equations.</li> <li>• Systems of linear equations. Cramers theorem. Gaussian elimination.</li> <li>• Vectors in <math>\mathbb{R}^3</math>, dot, cross, and mixed products. Applications of vector products.</li> <li>• Line and plane in 3D space vector, normal, parametric, canonical, intercept forms.</li> </ul>		
Prerequisites and co-requisites	Course content – exercises		
	<ul style="list-style-type: none"> <li>• Binary operations. Basic algebraic structures: group, ring, field, linear space.</li> <li>• Elements of modular arithmetic, tables of addition and multiplication modulo <math>n</math>. Inverse modulo <math>n</math>. Field <math>\mathbb{Z}_p</math>.</li> <li>• Field of complex numbers. Geometrical interpretation of complex numbers. Complex arithmetic. Complex roots. Simple equations in complex domain.</li> <li>• Ring of polynomials over field <math>K</math>. Roots of polynomials. Fundamental theorem of algebra. Polynomial factorization. Polynomial arithmetic with coefficients from field <math>K = \mathbb{Z}_p</math>. Synthetic division.</li> <li>• Matrices and determinants. Inverse matrix. Matrix equations.</li> <li>• Systems of linear equations. Cramers theorem. Gaussian elimination.</li> <li>• Vectors in <math>\mathbb{R}^3</math>, dot, cross, and mixed products. Applications of vector products.</li> <li>• Line and plane in 3D space vector, normal, parametric, canonical, intercept forms.</li> </ul>		
Assessment methods and criteria	No requirements		
	Subject passing criteria	Passing threshold	Percentage of the final grade
	Class participation	0.0%	10.0%
Recommended reading	Final comprehensive test	50.0%	90.0%
	Basic literature	<ul style="list-style-type: none"> <li>• T.Jankowski, <i>Linear algebra</i>, Publishing House of Gdansk University of Technology, Gdańsk, 2001.</li> <li>• <i>Elements of Linear Algebra</i>, Moodle course (by M.Łapińska and M.Musielak)</li> <li>• J.Topp, <i>Algebra</i>, Publishing House of Gdansk University of Technology, Gdańsk, 2005.</li> <li>• eCourse in Matrix Algebra: <a href="https://enauczanie.pg.edu.pl/moodle/course/view.php?id=2388">https://enauczanie.pg.edu.pl/moodle/course/view.php?id=2388</a></li> </ul>	
	Supplementary literature	<ul style="list-style-type: none"> <li>• K.Binmore, J.Davies, <i>Calculus</i>, Cambridge University Press, 2007.</li> <li>• C.Meyer, <i>Matrix analysis and applied linear algebra</i>, SIAM 2005</li> <li>• H. Anton, <i>Calculus with analytic geometry</i>, Wiley &amp; Sons, 1989</li> </ul>	
	eResources addresses		

<p>Example issues/ example questions/ tasks being completed</p>	<ol style="list-style-type: none"> <li>1. Solve the matrix equation <math>AX=B</math>, where A and B are given.</li> <li>2. Use Cramer formulas to find the y: <math>x+2y+2z+3t=3</math>, <math>3y+t=1</math>, <math>5x-2y+t=1</math>, <math>4x-5y+2t=1</math>.</li> <li>3. Find all the roots of the equation <math>z^3 - 8i=0</math>. Express them in algebraic form.</li> <li>4. Factor the polynomial <math>W(z)=z^3-iz^2-2iz-2</math>, knowing that one of its roots is <math>z_1=i</math>.</li> <li>5. Find the normal equation of the plane passing through the point <math>P=(1,-1,3)</math> and paralel to the vectors <math>a = [1,1,0]</math> and <math>b=[0,1,1]</math>.</li> <li>6. Determine the relative position of the lines <math>l_1 : x=1+t, y=-2-t, z=3+2t</math> and <math>l_2: x=4+s, y=-2+2s, z=4-3s</math>.</li> </ol>
<p>Practical activites within the subject</p>	<p>Not applicable</p>

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