



## Subject card

Subject name and code	Mathematics I, PG_00055371						
Field of study	Mechanical Engineering						
Date of commencement of studies	October 2024	Academic year of realisation of subject			2024/2025		
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			Polish		
Semester of study	1	ECTS credits			10.0		
Learning profile	general academic profile	Assessment form			exam		
Conducting unit	Mathematics Center -> Vice-Rector for Education						
Name and surname of lecturer (lecturers)	Subject supervisor	dr Stanisław Domachowski					
	Teachers	dr Stanisław Domachowski dr Leszek Ziemczonek mgr Mariusz Kaczmarek					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	45.0	60.0	0.0	0.0	0.0	105
	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	105		22.0		123.0	250
Subject objectives	The aim of this subject is for the student to obtain the competence in the range of using basic methods of mathematical analysis and linear algebra. Furthermore, the student is able to use this knowledge to solve simple theoretical and practical problems that can be found in the field of engineering.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_U01] is able to acquire information from specialized literary sources, databases and other resources, essential for solving engineering tasks; is able to compile the obtained information pieces and to interpret them, additionally is able to form conclusions and present justified opinion	Student combines knowledge of mathematics with knowledge from other fields.	[SU2] Assessment of ability to analyse information
	[K6_W01] possesses mathematical knowledge within the range of linear algebra and mathematical analysis useful in characterising and interpreting mechanical systems, technological processes and operational properties of devices	Student defines the basic concepts of differential calculus of one variable. Student analyses the properties of functions on the basis of an examination of its first and second derivatives. Student geometrically interprets the results of an examination of a graph of a function using the concept of limit, continuity and derivatives of functions. Student applies the basic rules and techniques of integration to calculate indefinite integrals. Student lists geometrical applications of definite integrals. Student distinguishes between types of improper integrals. Student performs calculations on complex numbers. Student defines basic notions of matrix calculus. Student calculates determinants of any degree. Student determines eigenvalues of matrices.	[SW1] Assessment of factual knowledge
Subject contents	Functions of one variable and their properties. The absolute value function definition, solving equations and inequalities with absolute value, graphs of functions with absolute value. Power functions solving power and polynomial equations and inequalities. Rational functions solving rational equations and inequalities. Exponential function properties and graphs, solving exponential equations and inequalities. Logarithmic functions properties and graphs, solving logarithmic equations and inequalities. Trigonometric and cyclometric functions properties and graphs, solving trigonometric equations and inequalities. Infinite sequences. Definition of a limit of a sequence, convergence and divergence, limit theorems. Limit of a function at a point, right-side limit of a function, left-side limit of a function, improper limit. Continuous function at a point, continuity of an inverse function. Differential calculus of one variable functions and its applications: Definition of a first derivative and differential. Rolle and Lagrange's theorems. Higher derivatives and differentials. Monotonicity and local extrema. Convexity, concavity and inflexion points of a function. De l'Hospital's Theorem. Asymptotes. Applying differential calculus to studying the properties of one variable functions. Integral calculus of one variable functions antiderivatives: The process of finding antiderivatives and integration formulas the substitution method of integration and integration by parts. Integration of rational, trigonometric and irrational functions. Definite integrals in Riemann's sense: Newton-Leibniz Theorem. Integration formulas, the substitution method of integration and integration by parts for definite integrals. Applications of integral calculus in computing areas of plane figures, lengths of arcs, volumes of solids of revolution. Improper integrals, applications of improper integrals. Complex numbers. Matrices, matrix operations, matrix inversion, determinants, rank of a matrix. Eigenvalues of the matrix. System of linear equations. Cramer's theorem. Kronecker-Capelli theorem. Gauss-Jordan elimination method.		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	written exam 90 minutes, tests, etest, • Active participation during classes	50.0%	100.0%
Recommended reading	Basic literature	W. Żakowski, G. Decewicz, Matematyka część 1 Analiza Matematyczna, Wydawnictwa Naukowo-Techniczne, Warszawa 1991, B. Wikieł, Matematyka, Podstawy z elementami matematyki wyższej, Wydawnictwo Politechniki Gdańskiej Gdańsk 2009, W. Kryszewski, L. Włodarski Analiza matematyczna w zadaniach część I, PWN, Warszawa 1986 W. Stankiewicz Zadania z matematyki dla wyższych uczelni technicznych, cz. I, PWN, Warszawa 1980, K. Jankowska, J. Jankowski, Zbiór zadań z matematyki, Wydawnictwo Politechniki Gdańskiej Gdańsk 2003. J. Dymkowska, D. Beger Rachunek całkowy w zadaniach" Wydawnictwo Politechniki Gdańskiej Gdańsk 2015, J. Dymkowska, D. Beger Rachunek różniczkowy w zadaniach" Wydawnictwo Politechniki Gdańskiej Gdańsk 2015,	

	Supplementary literature	<p>A. Kielbasa "Matematyka Matura 2009 Matura 2010 poziom podstawowy i rozszerzony" cz. I i II, Wyd. "2000", Warszawa 2008 Z. Cewe, J. Kobierowska, H. Nahorska, I. Stepuro, J. Witkowska "Matura z matematyki od roku 2010", Zbiór zadań maturalnych z zakresu kształcenia rozszerzonego, Wydawnictwo "Podkowa", Gdańsk 2010W. Jankowski Matematyka. Podręcznik dla wydziałów elektrycznych i mechanicznych politechnik, PWN, Warszawa 1967 W. Leksiński, I. Nabiałek, W. Żakowski Matematyka. Definicje, twierdzenia, przykłady, zadania-podręczniki akademickie, Wyd. NT, Warszawa 1994, K.Dobrowolska, praca zbiorowa Matematyka dla studiów technicznych dla pracujących Tom I, PWN, Warszawa 1981, R. Grzymkowski Matematyka, zadania i odpowiedzi, podręczniki akademickie, Wyd. Pracowni Komputerowej Jacka Skalmierskiego, Gliwice 2002 M. Gewert, Z. Skoczylas Analiza matematyczna 1, Przykłady i zadania, Oficyna Wydawnicza Gis, Wrocław 2005 J. Głazunow Matematyka wyższa, zbiór zadań z analizy funkcji jednej zmiennej, Wyd. Elbląskiej Uczelni Humanistyczno-Ekonomicznej, Elbląg 2006 M. Lassak Zadania z analizy matematycznej, Wyd. Wspierania Procesu Edukacji, Warszawa 2003</p>
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed	<ol style="list-style-type: none"> <li>1. Find the domain and range of the function <math>f(x)=...</math>. Determine the inverse function of <math>f</math></li> <li>2. Evaluate the limit of the given sequence <math>a_n=(3n^2+6n)^{\frac{1}{2}}-3^{\frac{1}{2}}n</math>.</li> <li>3. Evaluate the limit of the given function <math>f(x)=</math> at the point <math>x_0=</math></li> <li>4. Using the rules of differentiation find the derivative of the following function <math>f(x)=</math>.</li> <li>5. Evaluate the indefinite integral of the given rational function <math>f(x)=(x+3)(x^3+3x^2+4x+2)</math>.</li> <li>6. Sketch the graph of the function <math>f(x)=</math>. Identify any local extrema and inflection points.</li> <li>7. Determine indefinite integrals of the following functions using the method of integration by parts or the method of substitution.</li> <li>8. Find the volume of a solid of revolution obtained by rotating the graph of the function <math>f(x)=</math> about the OX-axis.</li> <li>9. Find the area of the surface obtained by rotating the arc <math>y=f(x)</math> about the OX-axis.</li> <li>10. Discuss the existence of solutions of the given system of linear equations.</li> <li>11. Find all eigenvalues of the matrix <math>A</math></li> </ol>	
Work placement	Not applicable	