GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Mathematics, PG_00057771						
Field of study	Green Technologies						
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	2		ECTS credits	9.0			
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 Hanna Guze				
	Teachers						

Lesson types							
	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	10.0	125.0	240

Subject objectives	
	Students obtain competence in using methods of mathematical analysis and linear algebra, and knowledge how to solve simple problems that are found in the field of engineering, in particular connected to green technologies and environment protection.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_K01] understands the need for learning throughout life, can inspire and organize the learning process of others. Is aware of his/ her own limitations and knows when to ask the experts, can properly identify priorities for implementation, critically evaluate his knowledge	Student recognizes the importance of self-expanding knowledge and takes the challenge of working with a group to solve a problem. Student is able to process the acquired information, analyze and interpret it, draw conclusions and reason opinions.	[SK5] Assessment of ability to solve problems that arise in practice
	[K6_U03] is able to use information and communication technologies relevant to the common tasks of engineering, is able to use known methods and mathematical-physical models to describe and explain phenomena and chemical processes	The student is able to skillfully use basic mathematical tools in the context of technical studies and apply mathematical methods in describing physical phenomena and chemical processes.	[SU4] Assessment of ability to use methods and tools
	[K6_W01] has a basic knowledge from some branches of mathematics and physics useful for formulating and solving simple problems in the field of environmental technologies and modern analytical methods	Student analyses properties of a given function of two variables using differential calculus of multivariable functions. Student defines the basic concepts of linear algebra. Student evaluates the limits of sequences, radius and interval of convergence of a power series. Student is able to determine the type of convergence of a number series. Student evaluates double and triple integrals and explains the methods of change of variables. Student knows various types of differential equations and selects the appropriate methods to solve them. Students explains the definitione of the cross product.	[SW1] Assessment of factual knowledge

Subject contents	Course content – lecture Infinite number series: necessary condition for convergence, criteria for convergence, alternating series, conditional and absolute convergence. Power series. Elements of Linear Algebra: matrices (definition, types of matrices, operations, inverse matrix),determinants (definition, properties), systems of linear equations (Cramer's rule, Kroneckera - Capelli theorem, Gaussian elimination). Analytic Geometry: vectors (dot product, cross product, mixed product, and their application). Conic sections and graphs of selected surfaces. Multivariable Functions: limits and continuity, partial derivatives with applications. Elements of field theory: scalar and vector fields. Gradient, divergence, rotation Integrals of multivariable functions: double integrals (definition, polar coordinates, application in geometry and physics), triple integrals (definition, cylindrical and spherical coordinates, application in geometry and physics). Ordinary Differential Equations: separable, homogeneous, Bernoulli, first order linear equations, linear of order n with constant coefficients, variation of parameters and undetermined coefficients method. Probability and Statistics: discrete and continuous random variable, probability distribution, expected value and variation of a random variable, distribution functions, elements of statistics. --- Course content – exercises Convergence criteria for number series. Conditional and absolute convergence. Interval of convergence of power series. Operations on matrices. Properties of determinants and their application. Inverse matrices and matrix equations. Systems of linear equations application of inverse matrices, Gauss elimination, and the Kronecker-Capelli theorem. Application of scalar, vector, and mixed products in geometry. Calculation and application of partial derivatives of functions of several variables. Analysis of the properties of functions of several variables using local and global extrema. Conversion of double and triple integrals to iterated integrals. Application of double and triple integrals in geometry. Application of polar, cylindrical, and spherical coordinates. Gradient of a scalar field, divergence and rotation of a vector field. Solving first-order and higher-order linear differential equations with constant coefficients using the method of variation of parameters and undetermined coefficients. Discrete and continuous random variables, distribution function, expected value and variance of a random variable. ---
Prerequisites and co-requisites	Working knowledge of the concepts of the first semester of mathematics.

<table>
<tr><td>Assessment methods and criteria</td><td colspan="2"><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Final Exam</td><td>45.0%</td><td>50.0%</td></tr>
<tr><td>Tests and activity during the classes.</td><td>0.0%</td><td>50.0%</td></tr>
</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>Sherman K. Stein, Calculus and analytic geometry, McGraw - Hill Book Company, 4th edition, 1987.

Howard Anton, Calculus. A new horizon., John Wiley and Sons Publishing Company, 6th edition, 1999.

D.J. Hartfiel, Arthur M. Hobbs, Elementary linear algebra, Prindle, Weber & Schmidt, Boston, 1987.

T. Jankowski, Linear algebra, Wydawnictwo Politechniki Gdańskiej, Gdańsk, 2001.

K. Jankowska, T. Jankowski, "Zbiór zadań z matematyki", cz. 2 i 3, PG Gdańsk.</td></tr>
<tr><td>Supplementary literature</td><td>M. Gewert, Z. Skoczylas,"Analiza matematyczna II - Definicje, twierdzenia, wzory", Oficyna Wydawnicza GiS.

M. Gewert, Z. Skoczylas,"Analiza matematyczna II - Przykłady i zadania", Oficyna Wydawnicza GiS.</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="2">1. Determine convergence of the series.
2. Find the Taylor expansion of the given function.
3. Find the inverse matrix.
4. Solve the given system of linear equations.
5. Sketch the graph of the following surface.
6. Evaluate the triple integral.
7. Find local extreme values of the function f(x,y)=... .
8. Find the general solution of the differential equation.
9. Compute the expected value and the variation of the given continuous random variable..</td></tr>
<tr><td>Practical activites within the subject</td><td colspan="2">Not applicable</td></tr>
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