



Subject card

Subject name and code	Mathematics II, PG_00058751						
Field of study	Environmental 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			Polish		
Semester of study	2	ECTS credits			8.0		
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 Cezary Mrozicki				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	60.0	0.0	0.0	0.0	90
	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	90		12.0		103.0	205
Subject objectives	Students obtain competence in the range of using methods of mathematical analysis and knowledge how to solve simple problems that can be found in the field of engineering.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	<p>[K6_W01] has knowledge in the field of mathematics, including: linear algebra, mathematical analysis and elements of mathematical statistics, probability theory, applications of mathematics, including mathematical methods and numerical methods, necessary for:</p> <p>1) description and analysis of hydrological phenomena; 2) description and analysis of meteorological phenomena; 3) solving project tasks of the sanitary industry;</p>	<p>The student mentions applications of double integrals and triple integrals. The student distinguishes between line integrals and applies appropriate methods to calculate them. The student distinguishes between surface integrals and uses appropriate methods to calculate them. The student recognizes different types of differential equations and selects the appropriate methods to solve them. The student solves linear differential equations of order n with constant coefficients using Laplace transform. The student recognizes the importance of skillful use of basic mathematical apparatus in terms of study in future.</p>	<p>[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects</p>
	<p>[K6_U01] has the ability to self-education, can obtain information from literature, databases and other sources, uses information technology, Internet resources; can integrate the obtained information, make their interpretation, as well as draw conclusions and formulate and justify opinions</p>	<p>A student defines the basic concepts of linear algebra. The student describes the methods of solving systems of linear equations. The student calculates the radius of convergence and determines the interval of convergence of a power series. The student applies the concept of functions of several variables to determine the extremes of the function. The student explains the method of substitution in double integral and triple integral. The student mentions applications of double integrals and triple integrals. The student distinguishes between line integrals and applies appropriate methods to calculate them. The student distinguishes between surface integrals and uses appropriate methods to calculate them. The student recognizes different types of differential equations and selects the appropriate methods to solve them. The student solves linear differential equations of order n with constant coefficients using Laplace transform. The student recognizes the importance of skillful use of basic mathematical apparatus in terms of study in future.</p>	<p>[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task</p>
<p>Subject contents</p>	<p>Course content – lecture</p> <p>Elements of linear algebra: Matrices (definition, types of matrices, matrix operations), determinants (definition and properties), rank of a matrix, system of linear equations (Cramer's rule, Kronecker-Capelli theorem, Gauss-Jordan elimination method). Number series and function series: Number series. Convergent and divergent series. Convergence tests for number series. Power series. Radius and interval of convergence. Taylors and Maclaurins series. Integration and differentiation of power series. Examples of applications - approximate calculation of integrals. Information on Fourier series Functions of two variables: Limit and continuity of a function of several variables. Partial derivatives. Total differential. Taylors formula. Maxima and minima of a function of several variables. Implicit functions. Double integral: Definition, properties, interpretation; expressing the double integral as an iterated integral; integration by substitution (polar coordinates); applications of double integrals. Triple integral: Definition, properties, interpretation; expressing the triple integral as an iterated integral; integration by substitution (cylindrical coordinates and spherical coordinates); application of triple integrals. Line integrals: Line integrals of the first kind - definition, properties and interpretation; transforming the line integral to the corresponding definite integral. Line integrals of the second kind (along oriented curves) - definition, properties and interpretation; transforming the line integral to the corresponding definite one; Green's theorem; path independence. Surface integrals: Integrals of the first kind - definition, properties and interpretation; transforming the surface integral to the corresponding double integral. Integrals of the second kind (surface-oriented) - definition, properties and interpretation; transforming the surface integral to the corresponding double integral; Gauss-Ostrogradski's theorem; Stoke's theorem. Applications of surface integrals. Ordinary differential equations: First order differential equations. General and particular solution. The Cauchy initial value problem. Variables separable, linear, Bernoulli, exact differential equations. Second order linear differential equations with constant coefficients. Fundamental set of solution of the homogeneous linear differential equation. Non-homogeneous linear differential equations. Higher order linear differential equations with constant coefficients.</p>		

Prerequisites and co-requisites	Knowledge of the subject: MATHEMATICS I.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Written exam	50.0%	50.0%
	Midterm colloquium	50.0%	50.0%
Recommended reading	Basic literature	<p>W. Krysicki, L. Włodarski, Analiza matematyczna w zadaniach 1, Wydawnictwo Naukowe PWN, Warszawa 2008 W. Krysicki, L. Włodarski, Analiza matematyczna w zadaniach 2, Wydawnictwo Naukowe PWN, Warszawa 2008 M. Gewert, Z. Skoczylas, Analiza matematyczna 1. Definicje. Twierdzenia. Wzory. Oficyna Wydawnicza GIS, Wrocław 2008 M. Gewert, Z. Skoczylas, Analiza matematyczna 2. Definicje. Twierdzenia. Wzory. Oficyna Wydawnicza GIS, Wrocław 2008 M. Gewert, Z. Skoczylas, Analiza matematyczna 1. Przykłady i zadania. Oficyna Wydawnicza GIS, Wrocław 2008 M. Gewert, Z. Skoczylas, Analiza matematyczna 2. Przykłady i zadania. Oficyna Wydawnicza GIS, Wrocław 2008 T. Jurlewicz, Z. Skoczylas, Algebra liniowa 1. Definicje. Twierdzenia. Wzory. Oficyna Wydawnicza GIS, Wrocław 2006 T. Jurlewicz, Z. Skoczylas, Algebra liniowa 1. Przykłady i zadania. Oficyna Wydawnicza GIS, Wrocław 2006 T. Jurlewicz, Z. Skoczylas, Algebra liniowa 2. Definicje. Twierdzenia. Wzory. Oficyna Wydawnicza GIS, Wrocław 2006 T. Jurlewicz, Z. Skoczylas, Algebra liniowa 2. Przykłady i zadania. Oficyna Wydawnicza GIS, Wrocław 2006 K. Jankowska, T. Jankowski, Zbiór zadań z matematyki, Wydawnictwo PG, Gdańsk 2008 K. Jankowska, T. Jankowski, Zadania z matematyki wyższej, Wydawnictwo PG, Gdańsk 2008 K. Jankowska, T. Jankowski, Funkcje wielu zmiennych. Całki wielokrotne. Geometria analityczna, Wydawnictwo PG, Gdańsk 2008</p>	
	Supplementary literature	W. Leksiński, I. Nabiątek, W. Żakowski, Matematyka. Definicje, twierdzenia, przykłady, zadania. WNT, Warszawa 2006	
	eResources addresses		
Example issues/ example questions/ tasks being completed	<ol style="list-style-type: none"> 1. Give the definition of the sum of the series. 2. Check whether the given series is convergent using the ratio test, the root test.. the comparison test or the integral test. 3. Discuss the existence of the solution for the given system of linear equations. 4. Compute partial differentials of the second order for the given function $f(x,y)$. 5. Find extreme values of the function $f(x,y)$. 		
Practical activities within the subject	Not applicable		

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