

## Subject card

Subject name and code	, PG_00041831							
Field of study	Ocean Engineering, Ocean Engineering							
Date of commencement of studies	October 2020		Academic year of realisation of subject			2020/2021		
Education level	first-cycle studies		Subject group			Obligatory subject group in the field of study		
Mode of study	Part-time studies		Mode of delivery			at the university		
Year of study	1		Language of instruction		Polish			
Semester of study	2		ECTS cred	CTS credits		9.0		
Learning profile	general academic profile As		Assessmer	nt form		exam		
Conducting unit	Mathematics Center -> Vice-Rector for Education							
Name and surname	Subject supervisor		dr Leszek Ziemczonek					
of lecturer (lecturers)	Teachers		dr Leszek Zie	emczonek				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Projec	t	Seminar	SUM
	Number of study hours	30.0	40.0	0.0	0.0		0.0	70
	E-learning hours included: 0.0							
	Adresy na platformie eNauczanie: WOiO - n.stac Matematyka 2 2020/21 (L.Ziemczonek) - Moodle ID: 6721 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=6721							
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	70	10.0			145.0		225
Subject objectives	The aim of this subject is for the student to obtain the competence in using the basic methods of multivariable calculus, and to be able to use this knowledge to solve simple theoretical and practical problems that are found in the field of engineering.							

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Learning outcomes	Course outcome	Subject outcome	Method of verification
Learning outcomes	[K6_U02] can work individually and in a team, communicate through various techniques in professional environment and also record, analyse, and present the results of work, can estimate the time needed to complete a given task	Student defines the basic concepts of linear algebra. Student describes the methods of solving systems of linear equations. Student calculates the radius of convergence and determines the interval of convergence of a power series. Student applies the concept of functions of several variables to determine the extreme values of the function. Student explains the method of change of variables in double integral and triple integral. Student explains applications of double and triple integrals. Student distinguishes between line integrals and applies appropriate methods to calculate them. Student distinguishes between surface integrals and uses appropriate methods to calculate them. Student recognizes different types of differential equations and selects the appropriate methods to solve them. Student solves linear differential equations of order n with constant coefficients using Laplace transform. Student recognizes the importance of skillful use of basic mathematical apparatus in terms of study in future.	[SU1] Assessment of task fulfilment
	[K6_W01] has a basic knowledge in maths, including algebra, elements of logics, geometry, mathematical analysis, theory of probability necessary to describe and analyse the operation of machines and ocean-technology objects	Student defines the basic concepts of linear algebra. Student describes the methods of solving systems of linear equations. Student calculates the radius of convergence and determines the interval of convergence of a power series. Student applies the concept of functions of several variables to determine the extreme values of the function. Student explains the method of change of variables in double integral and triple integral. Student explains applications of double and triple integrals. Student distinguishes between line integrals and applies appropriate methods to calculate them. Student distinguishes between surface integrals and uses appropriate methods to calculate them. Student recognizes different types of differential equations and selects the appropriate methods to solve them. Student solves linear differential equations of order n with constant coefficients using Laplace transform. Student recognizes the importance of skillful use of basic mathematical apparatus in terms of study in future.	[SW1] Assessment of factual knowledge

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Subject contents	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.
	Taylor's and Maclaurin's 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.
	Taylor's 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);

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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.

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	Fundamental set of solution of the homogeneous linear differential equation.  Non-homogeneous linear differential equations.  Higher order linear differential equations with constant coefficients.					
	Laplace Transform:					
	Definition, properties, inverse Laplace transform, solving differential equations using Laplace transform					
Prerequisites and co-requisites	Knowledge of subject: Mathematics I					
Assessment methods	Subject passing criteria	Passing threshold	Percentage of the final grade			
and criteria		50.0%	50.0%			
Sa Gillona	Tests during the semester					
	Written examination	50.0%	50.0%			
Recommended reading	Basic literature	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				
		za matematyczna 1. Definicje. /ydawnicza GIS, Wrocław 2008				
		M. Gewert, Z. Skoczylas, Analiza matematyczna 2. Definicje. Twierdzenia. Wzory. Oficyna Wydawnicza GIS, Wrocław 2008				
		ra matematyczna 1. Przykłady i 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, Z Wydawnictwo PG, Gdańsk 200	adania z matematyki wyższej, 8			
		Funkcje wielu zmiennych. Całki rczna, Wydawnictwo PG, Gdańsk 2008				

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	Supplementary literature	W. Leksiński, I. Nabiałek, W. Żakowski, Matematyka. Definicje, twierdzenia, przykłady, zadania. WNT, Warszawa 2006			
	eResources addresses	WOiO - n.stac Matematyka 2 2020/21 (L.Ziemczonek) - Moodle ID: 6721 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=6721			
Example issues/ example questions/ tasks being completed	Not applicable				
Work placement	Not applicable				

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