GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Mathematics 2, PG_00055876						
Field of study	Power Engineering, Power Engineering, Power Engineering						
Date of commencement of studies	October 2022		Academic year of realisation of subject	2022/2023			
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 Marcin Szyszkowski					
	Teachers	mgr Danuta Beger dr Marcin Szyszkowski					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	45.0	0.0	15.0	0.0	90
	E-learning hours included: 0.0						
	Matematyka 2 - Energetyka 2022/23 (D. Beger, M. Szyszkowski) - Moodle ID: 24463 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=24463						
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		98.0	200
Subject objectives	Student obtains competence in the range of using methods of mathematical analysis and linear algebra and skills to solve simple problems that can be found in the field of enginering.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_W01] has basic knowledge of mathematics necessary to describe the phenomena related to the processes of energy conversion and transfer; uses information technology to solve mathematical problems	Student performs calculations on complex numbers Student determines the real and complex roots of polynomials Student examines complex functions. Student knows the definition of the derivative of complex function. Student uses one variable integral to find area, center of mass plane figures and area and volume of rotational space figures. Student evaluates limits of a function of two variables. Student calculates partial derivatives of a function of two variables. Student analyses properties of a given function of two variables using differential calculus of multivariable functions. Student examines functions of several variables, using the concept of a limit, continuity and derivatives. Student determines local and global extrema of functions of two variables. Students calculates double integrals, and explains the method of substitution in the double integral. Student applies double integrals to solving geometrical problems (also in 3D space). Knows polar coordinates. Calculates triple integrals. Student can tell if a given series is convergent (knows basic criteria). Can find interval of convergence for a power series. Student demonstrates some techniques for solving ordinary differential equations. Student determines general and particular solutions of certain types of the first-order differential equations. Students finds the right method for solving ordinary differential equations. Student determines fundamental set of solutions of the homogeneous linear equation of order n with constant coefficients. Student determines general and particular solutions of higher orders linear differential equations with constant coefficients. Student uses mathematical packages to perform calculations and visualization of mathematical concepts.	[SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge
	[K6_U02] is able to apply the learned mathematical methods to the analysis and design of elements, systems and energy systems	Student can understand and apply complex numbers used to describe electrical circuits. Student can apply of two variable calculus to find characteristic points of a two (or three) variable function (maximum/minimum/saddle point) . Student is able to set up a one or two variable integral to obtain e.g. amount of work/energy (or simply amount of paint) needed in some physical process. Student solves (simple) differential equations arising from (simple) electrical circuits.	[SU3] Assessment of ability to use knowledge gained from the subject

Course outcome	Subject outcome	Method of verification
[K6_K01] is aware of the need for training and self-improvement in the profession of energy and the possibility of further education; can think and act in a creative and entrepreneurial manner; can define priorities for the implementation of an individual or group task	Student recognizes the importance of self-expanding knowledge and takes the challenge of working with a group to solve a problem. Student understands the need of lifelong learning. Student is able to inspire others and organize their learning process.	[SK4] Assessment of communication skills, including language correctness [SK3] Assessment of ability to organize work

Subject contents

Integral calculus of functions of one variable

- Definite integrals and their applications (volumes, areas of revolving figures) Improper integrals.

Complex numbers

- Algebraic, trigonometric and exponential form of a complex number
- Operations on complex numbers, solving eqations, applications to real polynomials.

Analitic geometry

- Equation of the plane in 3D space,
- equation of the line in space.
- Vector product, dot product and mixed product of two vectors (in 3D space).

Ordinary differential equations

- Ordinary first order differential equations
- Higher order linear differential equations with constant coefficients.
- Systems of linear differential equations .

Integral calculus of functions of several variable

- Functions of two variables. The differential calculus. The double and triple integrals.
- Line integral of a scalar field, line integral of a vector field
- Surface integral, flux integral

Multivariable calculus

- Two variable functions (limit, continuity), partial derivatives.
- Calculus of two variables, extrema and saddle points. Opimalization problems.
- Double integral (over simple regions, changig orgers of intrgration).
- Polar coordinates and double integrals.
- Funtions of three variables, triple integrals (sferical and cylindrical coordinates).

Series and power series

- Basic thms for convergent series (comparison thm. integral thm.)
- D\Alembert and Cauchy theorem.
- Power series, finding interval of convergence.

Differential equations

- Differential equations with separe variables.
- Linear equations (homogenous and nonhomogenous).
- Linear equations of higher degree with constat coefficients

Partial differential equations

- examples of partial dierential equations

Prerequisites and co-requisites

Mthematics I passed

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Exam	50.0%	40.0%
Midterm colloquium	50.0%	60.0%

Recommended reading

Basic literature

Bibliography

1. Leja F., *Rachunek różniczkowy i całkowy*, PWN Warszawa 1962
2. Żakowski W., Leksiński W., *Matematyka cz. IV*, Wydawnictwo Naukowo-Techniczne, Warszawa, 1971

	Supplementary literature	Supplementary Bibliography 1. Fichtenholtz, G. M., *Rachunek różniczkowy i całkowy, t. 1-2*, PWN Warszawa 1962 2. Jankowska K., Jankowski T., *Zbiór zadań z matematyk*i, Wydawnictwo PG Gdańsk 1998 3. Krysicki W., Włodarski L., *Analiza matematyczna w zadaniach, cz. II*, PWN Warszawa 1994 4. Pogorzelski W., *Analiza matematyczna, t. 2-3*, PWN Warszawa 1956
	eResources addresses	Uzupełniające https://wazniak.mimuw.edu.pl/index.php?title=Analiza_matematyczna_2 - Course of Calculus on Warsaw Univ. (for nonmatematicians)
Example issues/ example questions/ tasks being completed	1. Find volume/area of a circular figure, the line integral to arc lenth. 2. Compute e.g. (-3+3i)^14, write cube roots of (sqrt(3)-i). 3. Find a plane passing throug three given points. 4. Point on the plane clossest to a given point. 5. Determine extrema/saddle points for a function of two variables. 6. Find a tangent plane to the graph of two variable f-tion. 7. Find min.max of a two fariable f-ion on a disc/halfdisc/triangle ect. 8. Find the volumes of the given solids by means of double integral (or by means of triple integral). 9. Replace double integral by an integrai in polar coordinates. 10. Find area of a lamina (e.g. in polar coordinates). 11. Determine if a series is convergent. 12. Determine the interval where a given power series is convergent. 13. Solve diff. equation with separate variables 14. Solve linear diff. equation (nonhomogenous). 15. Solve linara fiff. equation of higher order and constant coeficients.	
Work placement	Not applicable	