



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 2023	Academic year of realisation of subject			2023/2024		
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 Magdalena Musielak					
	Teachers	dr Magdalena Musielak dr inż. Wojciech Włodarski mgr Danuta Beger					
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						
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 engineering.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_U02] is able to apply the learned mathematical methods to the analysis and design of elements, systems and energy systems	<p>Student can understand and apply complex numbers used to describe electrical circuits.</p> <p>Student can apply of two variable calculus to find characteristic points of a two (or three) variable function (maximum/minimum/saddle point) .</p> <p>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.</p> <p>Student solves (simple) differential equations arising from (simple) electrical circuits.</p>	[SU3] Assessment of ability to use knowledge gained from the subject
	[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	<p>Student recognizes the importance of self-expanding knowledge and takes the challenge of working with a group to solve a problem.</p> <p>Student understands the need of lifelong learning. Student is able to inspire others and organize their learning process.</p>	<p>[SK4] Assessment of communication skills, including language correctness</p> <p>[SK3] Assessment of ability to organize work</p>

	Course outcome	Subject outcome	Method of verification
	<p>[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</p>	<p>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.</p>	<p>[SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge</p>

Subject contents	<p>Complex numbers (revision from sem.1)</p> <ul style="list-style-type: none"> Algebraic, trigonometric and exponential form of a complex number Operations on complex numbers, solving equations, applications to real polynomials. <p>Multivariable calculus</p> <ul style="list-style-type: none"> Two variable functions (limit, continuity), partial derivatives. Calculus of two variables, extrema and saddle points. Optimization problems. Double integral (over simple regions, changing orders of integration). Polar coordinates and double integrals. Applications <p>Ordinary differential equations</p> <ul style="list-style-type: none"> Ordinary first order differential equations Higher order linear differential equations with constant coefficients. Systems of linear differential equations . <p>Series and power series</p> <ul style="list-style-type: none"> Basic thms for convergent series (comparison thm. integral thm.) D'Alembert and Cauchy theorem. Power series, finding interval of convergence. <p>Differential equations</p> <ul style="list-style-type: none"> Differential equations with separate variables. Linear equations (homogenous and nonhomogenous). Linear equations of higher degree with constant coefficients <p>Analytic geometry</p> <ul style="list-style-type: none"> 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). 														
Prerequisites and co-requisites	Mathematics I passed														
Assessment methods and criteria	<table border="1"> <thead> <tr> <th data-bbox="448 1249 794 1294">Subject passing criteria</th> <th data-bbox="794 1249 1141 1294">Passing threshold</th> <th data-bbox="1141 1249 1477 1294">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="448 1294 794 1328">Project</td> <td data-bbox="794 1294 1141 1328">0.0%</td> <td data-bbox="1141 1294 1477 1328">10.0%</td> </tr> <tr> <td data-bbox="448 1328 794 1361">Final Exam</td> <td data-bbox="794 1328 1141 1361">40.0%</td> <td data-bbox="1141 1328 1477 1361">50.0%</td> </tr> <tr> <td data-bbox="448 1361 794 1395">Midterm tests</td> <td data-bbox="794 1361 1141 1395">0.0%</td> <td data-bbox="1141 1361 1477 1395">40.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Project	0.0%	10.0%	Final Exam	40.0%	50.0%	Midterm tests	0.0%	40.0%
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Recommended reading	Basic literature	Bibliography <ol style="list-style-type: none"> Leja F., <i>Rachunek różniczkowy i całkowy</i>, PWN Warszawa 1962 Żakowski W., Leksiński W., <i>Matematyka cz. IV</i>, Wydawnictwo Naukowo-Techniczne, Warszawa, 1971 													
	Supplementary literature	Supplementary Bibliography <ol style="list-style-type: none"> Fichtenholtz, G. M., <i>Rachunek różniczkowy i całkowy, t. 1-2</i>, PWN Warszawa 1962 Jankowska K., Jankowski T., <i>Zbiór zadań z matematyki</i>, Wydawnictwo PG Gdańsk 1998 Krysicki W., Włodarski L., <i>Analiza matematyczna w zadaniach, cz. II</i>, PWN Warszawa 1994 Pogorzelski W., <i>Analiza matematyczna, t. 2-3</i>, PWN Warszawa 1956 													

	eResources addresses	Adresy na platformie eNauczenie: Energetyka - Matematyka I i II, 2023/24 (M.Musielak, D.Beger) - Moodle ID: 32157 https://enauczenie.pg.edu.pl/moodle/course/view.php?id=32157 Ankieta 2023/2024 - Moodle ID: 31301 https://enauczenie.pg.edu.pl/moodle/course/view.php?id=31301
Example issues/ example questions/ tasks being completed	1. Compute e.g. $(-3+3i)^{14}$, write cube roots of $(\sqrt{3}-i)$. 2. Find a plane passing through three given points. 3. Point on the plane closest to a given point. 4. Determine extrema/saddle points for a function of two variables. 5. Find a tangent plane to the graph of two variable f-tion. 6. Find min.max of a two fariable f-ion on a disc/halldisc/triangle ect. 7. Find the volumes of the given solids by means of double integral (or by means of triple integral). 8. Replace double integral by an integrai in polar coordinates. 9. Find area of a lamina (e.g. in polar coordinates). 10. Determine if a series is convergent. 11. Determine the interval where a given power series is convergent. 12. Solve diff. equation with separate variables 13. Solve linear diff. equation (nonhomogenous). 14. Solve linara fiff. equation of higher order and constant coefficients.	
Work placement	Not applicable	

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