



Subject card

Subject name and code	Mathematics, PG_00054407						
Field of study	Electronics and Telecommunications						
Date of commencement of studies	February 2024	Academic year of realisation of subject			2023/2024		
Education level	second-cycle studies	Subject group			Obligatory subject group in the field of study Subject group related to scientific research 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	1	ECTS credits			6.0		
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 Hanna Guze					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	15.0	0.0	0.0	0.0	45
	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	45		10.0		95.0	150
Subject objectives	The use of specialized mathematical tools to technical subjects.						
Learning outcomes	Course outcome		Subject outcome			Method of verification	
	[K7_W01] Knows and understands, to an increased extent, mathematics to the extent necessary to formulate and solve complex issues related to the field of study.		Student knows the basic concepts and theorems of linear algebra, knows the basics of functional analysis, knows the types of differential and integral equations, knows theorems and techniques of solving ordinary differential equations and partial differential equations.			[SW1] Assessment of factual knowledge	
	[K7_U01] can apply mathematical knowledge to formulate and solve complex and non-typical problems related to the field of study by:n-appropriate selection of source information and its critical analysis, synthesis, creative interpretation and presentation,n-application of appropriate methods and toolsn		Student uses the notion of linear space, linear transformation, determines matrices of linear transformations in different bases, demonstrates methods for solving differential and integral equations, analyzes stability of linear and nonlinear systems differential equations.			[SU4] Assessment of ability to use methods and tools	

Subject contents	<p>Linear space. Basic concepts. Linear subspace. Basis and dimension of linear space. Coordinates of vector to the base. Linear operators. Basic concepts. Matrix of linear transformation. Change of basis matrix. Hilbert Space. Space $L^2[-,]$.</p> <p>First order ordinary differential equations. Basic concepts. Separable equations. Bernoulli equation. Lagrange equation and Clairaut equation. Exact equations. Integrating factor. Higher order linear equations with constant coefficients. Higher order Euler equations. Second order linear equations with nonconstant coefficients. Systems of differential equations. Qualitative analysis of solutions of ordinary differential equations. Lapunov stability.</p> <p>Integral equations. Basic terminology. Classification. Volterra and Fredholm equation. Transforming differential equations into integral equations. Methods for solving integral equations. Successive approximations, iterated kernels, resolvent.</p> <p>Partial differential equations. Basic concepts. First order partial differential equations. Linear partial differential equations of second order. Methods to solve linear partial differential equations of second order. Classification of equations. Reducing equations to canonical form. Wave equation in one dimensional case. Wave equation. Heat conduction equation. Laplace equation.</p>											
Prerequisites and co-requisites												
Assessment methods and criteria	<table border="1" data-bbox="448 725 1489 824"> <thead> <tr> <th data-bbox="448 725 794 757">Subject passing criteria</th> <th data-bbox="794 725 1141 757">Passing threshold</th> <th data-bbox="1141 725 1489 757">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="448 757 794 788">Final exam</td> <td data-bbox="794 757 1141 788">50.0%</td> <td data-bbox="1141 757 1489 788">80.0%</td> </tr> <tr> <td data-bbox="448 788 794 824">Homework assignments</td> <td data-bbox="794 788 1141 824">0.0%</td> <td data-bbox="1141 788 1489 824">20.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Final exam	50.0%	80.0%	Homework assignments	0.0%	20.0%
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Final exam	50.0%	80.0%										
Homework assignments	0.0%	20.0%										
Recommended reading	Basic literature	<ol style="list-style-type: none"> 1. Topp, J., Algebra, Wydawnictwo Politechniki Gdańskiej 2. Żakowski, W., Leksiński, W., Podręczniki Akademickie - Matematyka. Część IV, Wydawnictwo Naukowe PWN 3. Roman, S., Advanced Linear Algebra, Third Edition, Springer 4. Tveito, A., Winther, R., Introduction to Partial Differential Equations, Springer 5. L. C. Evans, Partial Differential Equations, AMS. 6. Hochstadt, H., Integral Equations, A Wiley-Interscience Publications 7. M.I. Krasnov, G.I. Makarenko, A.I. Kiselev, Problems and exercises in the calculus of variations., Mir Publishers. 8. Palczewski, A., Równania różniczkowe zwyczajne, Wydawnictwo Naukowe PWN 9. Debnath, L., Mikusinski, P., Hilbert Spaces with Applications, Third Edition, Elsevier Academic Press 										
	Supplementary literature	<ol style="list-style-type: none"> 1. Matwiejew, N. M., Zadania z równań różniczkowych zwyczajnych, Wydawnictwo Naukowe PWN 2. Krasnow, M. L., Kiselew, A. I., Makarenko, G. I., Zadania z równań całkowych, Wydawnictwo Naukowe PWN 3. Rutkowski, J., Algebra abstrakcyjna w zadaniach, Wydawnictwo Naukowe PWN 										
	eResources addresses	<p>Adresy na platformie eNauczenie:</p> <p>WETI - EiT II stopien - Matematyka 2023/24 (M.Musielak) - Moodle ID: 36644</p> <p>https://enauczenie.pg.edu.pl/moodle/course/view.php?id=36644</p>										
Example issues/ example questions/ tasks being completed	<ol style="list-style-type: none"> 1. Verify if the given transformation $T : R_{2 \times 2} R_2[x]$ is linear. In case of positive answer find $\ker T$, $\text{im } T$, $\dim \ker T$, $\dim \text{im } T$. $T \begin{pmatrix} a & b \\ c & d \end{pmatrix} = ax^2 + (b-c)x + d$ ($R_{2 \times 2}, +, \cdot$) vector space of real matrices of order 2, with addition and scalar multiplications, ($R_2[x], +, \cdot$) vector space of real polynomials of order at most 2, with addition and scalar multiplications.) 2. Solve the following nonhomogeneous linear equation. $y''' + y'' = (x-1)/(x^2)$. 3. Examine stability of equilibrium points of the system $\begin{cases} x' = xy + 2y^2 \\ y' = (y-1)(x+2) \end{cases}$ 4. Find the integral surface passing through given curve $(u)/(x) + y(u)/(y) = u^2y$, $y=t$, $u=t^2$, $u=1$. 5. Classify the equation and find its characteristics $(2u)/(x^2) - 2 \cos x (2u)/(xy) - (3 + \sin^2 x) (2u)/(y^2) - y(u)/(y) = 0$. 6. Find the resolvent kernel, if $K(x,t) = x^2 t^2$; $a=-1$, $b=1$. 											
Work placement	Not applicable											