



## Subject card

Subject name and code	Numerical Methods, PG_00038088						
Field of study	Automation, Robotics and Control Systems						
Date of commencement of studies	October 2023	Academic year of realisation of subject			2023/2024		
Education level	first-cycle studies	Subject group					
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			3.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Faculty of Electrical and Control Engineering						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Mirosław Wołoszyn					
	Teachers	mgr inż. Dmytro Kondratenko dr hab. inż. Mirosław Wołoszyn mgr inż. Krzysztof Łuksza dr inż. Wiktoria Stahl					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	30.0	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	4.0		26.0		75
Subject objectives	Knowledge of basic numerical methods used in engineering calculations. Knowledge of numerical libraries and mastering the skills to use them.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K6_W01] has basic knowledge in the field of mathematics including algebra, geometry, mathematical analysis, probabilistics, numerical methods - necessary to describe and analyze automation and robotics systems	Student has a basic knowledge of numerical methods			[SW1] Assessment of factual knowledge		
	[K6_U05] can use analytical and simulation methods to solve tasks in the field of automation and robotics and use various techniques to carry out engineering tasks related to automation and robotics devices and systems	Student will be able to use computer tools for numerical calculations			[SU4] Assessment of ability to use methods and tools		
Subject contents	Computer arithmetic and round-off error, floating-point representation. Numerical matrix algebra: systems of linear algebraic equations, Gauss elimination, Gauss - Jordan elimination, LU decomposition, computation of the inverse matrix, iterative methods. Nonlinear algebraic equations: one equation: bisection, regula-falsi method, secant method, Newtons method, system of equations: fixed-point iterations, Newtons method. Function interpolation: Lagrange polynomials. Numerical differentiation of a function of one variable, backward, centered, and forward differences. Approximation of functions: least-squares in polynomials. Numerical integration of one-dimensional integrals: Newton-Cotes rules, Romberg integration, Gauss-Legendre quadrature, singular integrands, integrals over infinite domains. Initial-value problems for ordinary differential equations: polynomial approximation, Euler method.						
Prerequisites and co-requisites	no prerequisites						
Assessment methods and criteria	Subject passing criteria	Passing threshold			Percentage of the final grade		
	tests and work on exercises	60.0%			88.0%		
	tasks from lectures	60.0%			12.0%		

Recommended reading	Basic literature	<p>Z. Fortuna, B. Macukow, J. Wąsowski: Metody numeryczne, WNT Warszawa 1982</p> <p>J. i M. Jankowscy: Przegląd metod i algorytmów numerycznych. cz. 1, WNT Warszawa 1981.</p> <p>M. Dryja, J. i M. Jankowscy: Przegląd metod i algorytmów numerycznych. cz. 2, WNT Warszawa 1982</p>
	Supplementary literature	<p>C. Pozrikidis: Numerical Computation in Science and Engineering, Oxford University Press 1998.</p> <p>A. Krupowicz: Metody numeryczne zagadnień początkowych równań różniczkowych zwyczajnych. PWN Warszawa 1986.</p>
	eResources addresses	<p>Adresy na platformie eNauzanie:</p> <p>METODY NUMERYCZNE [ARiSS][2023/24] - Moodle ID: 36041  <a href="https://enauzanie.pg.edu.pl/moodle/course/view.php?id=36041">https://enauzanie.pg.edu.pl/moodle/course/view.php?id=36041</a></p> <p>METODY NUMERYCZNE [ARiSS][2023/24] - Moodle ID: 36041  <a href="https://enauzanie.pg.edu.pl/moodle/course/view.php?id=36041">https://enauzanie.pg.edu.pl/moodle/course/view.php?id=36041</a></p> <p>METODY NUMERYCZNE [ARiSS][2023/24] - Moodle ID: 36041  <a href="https://enauzanie.pg.edu.pl/moodle/course/view.php?id=36041">https://enauzanie.pg.edu.pl/moodle/course/view.php?id=36041</a></p> <p>METODY NUMERYCZNE [ARiSS][2023/24] - Moodle ID: 36041  <a href="https://enauzanie.pg.edu.pl/moodle/course/view.php?id=36041">https://enauzanie.pg.edu.pl/moodle/course/view.php?id=36041</a></p>
Example issues/ example questions/ tasks being completed	<p>The solution of equations by Gauss, LU, GS. Lagrange interpolation function method. Approximation of the function <math>\sin(x)</math> using the mean square approximation. Calculation of integrals by Simpson. The solution of nonlinear equations using Newton's method. The solution of differential equations using Euler's method.</p>	
Work placement	<p>Not applicable</p>	