



Subject card

Subject name and code	Numerical methods , PG_00025516						
Field of study	Mathematics						
Date of commencement of studies	October 2024	Academic year of realisation of subject			2026/2027		
Education level	first-cycle studies	Subject group			Optional subject group Subject group related to scientific research in the field of study		
Mode of study	Full-time studies	Mode of delivery			blended-learning		
Year of study	3	Language of instruction			Polish		
Semester of study	5	ECTS credits			5.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Department of Differential Equations and Mathematical Applications -> Faculty of Applied Physics and Mathematics						
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Paweł Wojda					
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	15.0	15.0	0.0	0.0	60
	E-learning hours included: 31.0 Adresy na platformie eNauczenie:						
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	60	5.0	60.0	125		
Subject objectives	The aim of the course is to acquaint the student with issues related to numerical methods of solving mathematical problems.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	K6_W08	Student: - uses the instructions, functions and procedures of the Mathematica and C environment			[SW1] Assessment of factual knowledge		
	K6_U07	Student: - uses self-written programs for testing numerical methods; - can choose the appropriate method for the analytical problem under consideration; - uses appropriate numerical methods to solve mathematical problems.			[SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject		
	K6_W04	Student: - uses the basic theorems in algebra and mathematical analysis.			[SW1] Assessment of factual knowledge		
	K6_U10	Student: - uses self-written programs for testing numerical methods; - can choose the appropriate method for the analytical problem under consideration; - uses appropriate numerical methods to solve mathematical problems.			[SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment		

Subject contents	<ol style="list-style-type: none"> 1. Computer arithmetic: absolute and relative error, fixed and floating point representation of numbers. 2. Numerical stability and numerical accuracy of algorithms. 3. Solving nonlinear equations (scalar equations and systems of equations): iteration method, bisection method, Newton's method, secant method; analysis of error and order of convergence of each of the iterative methods considered. 4. Algorithm for a tridiagonal matrix (Thomas algorithm). 5. Solving linear systems of equations - direct and iterative methods. 6. Gram Schmidt orthogonalization, Householder's method. 7. Approximation and interpolation of functions: polynomial interpolation, Lagrange interpolation polynomial, Newton interpolation polynomial, polynomial interpolation error, differential ratios and their properties, Hermite interpolation. 8. Integration and numerical differentiation: use of Taylor's formula for approximation of derivatives, application of polynomial interpolation, Richardson extrapolation; Newton-Cotes quadratures - simple and complex formulas for trapeze and Simpson and analysis of their errors, change of integration interval, Gauss quadrature. 9. Numerical solution of ordinary differential equations and partial differential equations: single and multi-step methods, construction, convergence analysis. 											
Prerequisites and co-requisites	Passed exams in Algebra and Mathematical Analysis.											
Assessment methods and criteria	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 40%;">Subject passing criteria</th> <th style="width: 30%;">Passing threshold</th> <th style="width: 30%;">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td>Passing the laboratory</td> <td>50.0%</td> <td>30.0%</td> </tr> <tr> <td>Tests and tasks</td> <td>50.0%</td> <td>70.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Passing the laboratory	50.0%	30.0%	Tests and tasks	50.0%	70.0%
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Recommended reading	Basic literature	<ol style="list-style-type: none"> 1. Kincaid D., Cheney W.: Analiza numeryczna, WNT, Warszawa, 2006. 2. Krzyżanowski P.: Obliczenia inżynierskie i naukowe, PWN, Warszawa, 2011. 3. Jankowska J., Jankowski M., Dryja M: Przegląd metod i algorytmów numerycznych cz. 1 i 2, WNT, Warszawa, 1988. 										
	Supplementary literature	<ol style="list-style-type: none"> 1. G. Dahlquist, A. Bjork, Metody numeryczne, PWN 1983. 2. J. Stoer, R. Bulirsch, Wstęp do analizy numerycznej, PWN 1987. 										
	eResources addresses											
Example issues/ example questions/ tasks being completed	<ol style="list-style-type: none"> 1. Determine the polynomial interpolating the tabular function and estimate the obtained interpolation error. 2. Derive the Newton iterative method of approximate the root of a given number. 											
Work placement	Not applicable											