GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Numerical methods , PG_00025516		
Field of study	Mathematics		
Date of commencement of studies	October 2023	Academic year of realisation of subject	2025/2026
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 eNauczanie:

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_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.	[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information
K6_W04	Student: - uses the basic theorems in algebra and mathematical analysis.	[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.	[SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information
K6_W08	Student: - uses the instructions, functions and procedures of the Mathematica and C environment	[SW1] Assessment of factual knowledge

Subject contents	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

Subject passing criteria	Passing threshold	Percentage of the final grade
Tests and tasks	50.0%	70.0%
Passing the laboratory	50.0%	30.0%

Recommended reading

Basic literature

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

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

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