



## Subject card

Subject name and code	Numerical Methods and Algorithms, PG_00047837						
Field of study	Biomedical Engineering						
Date of commencement of studies	October 2022	Academic year of realisation of subject			2024/2025		
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			at the university		
Year of study	3	Language of instruction			Polish		
Semester of study	6	ECTS credits			3.0		
Learning profile	general academic profile	Assessment form			exam		
Conducting unit	Department of Biomedical Engineering -> Faculty of Electronics, Telecommunications and Informatics						
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Artur Poliński					
	Teachers	dr inż. Artur Poliński					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	15.0	0.0	0.0	30
	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	30		3.0		42.0	75
Subject objectives	Introduction to numerical analysis						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K6_W01] Knows and understands, to an advanced extent, mathematics necessary to formulate and solve simple issues related to the field of study	has basic knowledge of numerical methods useful in issues related to biomedical engineering			[SW1] Assessment of factual knowledge		
	[K6_U01] can apply mathematical knowledge to formulate and solve complex and non-typical problems related to the field of study and perform tasks, in an innovative way, in not entirely predictable conditions, by:n- appropriate selection of sources and information obtained from them, assessment, critical analysis and synthesis of this information,n- selection and application of appropriate methods and toolsn	- Numerical solution of systems of linear equations,			[SU1] Assessment of task fulfilment		
Subject contents	1. Floating point calculations, the accuracy of calculations, condition, stability of algorithms, norms 2. Direct methods for solving linear systems of equations (Gauss elimination, Jordan, LU) 3. Iterative methods of solving linear system of equations (Jacobi, Gauss-Seidel, overrelaxation) 4. Stop criteria for iterative methods, sparse linear system of equations 5. Interpolation (Lagrange, Newton, spline functions) 6. Least squares (polynomial, orthogonal polynomial) 7. Least squares (trigonometric functions, spline functions) 8. Uniform approximation (power series, Pade approximant, Chebyshev approximation) 9. Approximate solution of nonlinear equations and systems of nonlinear equations (bisection, secant method) 10. Approximate solution of nonlinear equations and systems of nonlinear equations (simple iteration, Newton method) 11. Numerical integration (Newton-Cotes quadrature, Romberg method) 12. Numerical integration (Gaussian quadrature) 13 Some numerical methods for optimizing problems 14 Introduction to the finite element method (FEM) and boundary element method (BEM). 15 Application of FEM and BEM in computer assisted design						
Prerequisites and co-requisites	No requirements						

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	laboratory	51.0%	60.0%
	exam	51.0%	40.0%
Recommended reading	Basic literature	Beer G., Watson J. O., Introduction to finite and boundary element methods for engineers, John Wiley 1994 Biran A., Breiner M., MATLAB 5 for engineers, Harlow, England : Addison-Wesley, 1999 Björck ., Dahlquist G., Metody numeryczne, PWN 1983 Dryja M., Jankowska J., Jankowski M., Przegląd metod i algorytmów numerycznych. Cz. 2, WNT 1988 Fortuna Z., Macukow B., Wąsowski J., Metody numeryczne, WNT 2006 Golub G., Van Loan C., Matrix Computations. Johns Hopkins University Press, 1996 Jankowscy J. i M., Przegląd metod i algorytmów numerycznych. Cz. 1, WNT 1988 Ralston A., Wstęp do analizy numerycznej, PWN 1983 Stoer J., Bulirsch R., Wstęp do analizy numerycznej, PWN 1987 Zienkiewicz O. C., Metoda elementów skończonych, Arkady 1972	
	Supplementary literature	No requirements	
	eResources addresses	Adresy na platformie eNauczenie:	
Example issues/ example questions/ tasks being completed			
Work placement	Not applicable		