

SDAŃSK UNIVERSITY 的 OF TECHNOLOGY

Subject card

Subject name and code	Numerical methods, PG_00052076								
Field of study	Nanotechnology								
Date of commencement of studies	October 2020		Academic year of realisation of subject			2021/2022			
Education level	first-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	2		Language of instruction			Polish			
Semester of study	4		ECTS credits		4.0				
Learning profile	general academic profile		Assessment form		assessment				
Conducting unit	Instytut Nanotechnologii i Inżynierii Materiałowej -> Faculty of Applied Physics and Mathematics								
Name and surname	Subject supervisor		dr hab. inż. Jacek Dziedzic						
of lecturer (lecturers)	Teachers		dr hab. inż. Jacek Dziedzic						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Projec	t	Seminar	SUM	
	Number of study hours	15.0	0.0	30.0	0.0		0.0	45	
	E-learning hours included: 0.0								
	Adresy na platformie eNauczanie: Metody numeryczne - Moodle ID: 22592 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=22592								
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		5.0		50.0		100	
Subject objectives	The aim of this class is to familiarise students with numerical methods for data processing. After a brief introduction devoted to floating-point arithmetics, we cover the most important classes of numerical methods algorithms for numerical integration, methods of solving nonlinear equations, function approximation, Monte-Carlo methods. In the laboratory part, students are introduced to the Mathematica symbolic computation package, which they subsequently employ in practical problems, thus consolidating the acquired theoretical knowledge.								

Learning outcomes	Course outcome	Subject outcome	Method of verification				
	K6_U01	The student has the ability to extend their knowledge by consulting the content provided by the teacher. He can also find and use other sources (built-in help, user manuals).	[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task				
	K6_K04	The student is able to work in a group of several people on one specific issue. The student is able to identify and implement steps leading to the goal.	[SK4] Assessment of communication skills, including language correctness [SK5] Assessment of ability to solve problems that arise in practice [SK1] Assessment of group work skills				
	K6_U03	The student knows how to program in the Mathematica symbolic computation language and, optionally, in a high-level language of his/her choice that is customarily used in numerical computations (eg C, C ++, Fortran).	[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task				
	K6_W04	The student has an extended and structured knowledge of IT tools used for numerical and symbolic calculations. The student is able to create a simple program in the Mathematica symbolic computation language.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects				
Subject contents							
	Methods of integrating functions of one variable: quadrature with fixed nodes, Newton-Cotes quadrature, Romberg's method, Gauss quadrature.						
	method.						
	Approximation and interpolation of functions: Lagrange interpolation formula, Newton interpolation formulas, mean square and polynomial approximation, orthogonal polynomials, trigonometric approximation.						
	Monte Carlo method applied to the calculation of the definite integral of functions of one and many variables.						
	The Mathematica package: arithmetics, function notation, built-in functions, variables, assignment, delayed assignment, basic symbolic calculations, partial and total derivatives, indefinite and definite integrals, user-defined functions, boolean logic, graphing functions, solving equations and systems of equations - symbolically and numerically, substitutions and rules, lists and list operations, importing numerical data and fitting, loops and conditions.						
Prerequisites and co-requisites	Basic: Basics of calculus (continuous functions, Riemann integral, minimisation of a function, zeroes of a function, partial and total derivatives).						
	Additional: Fourier series.						
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade				
	lab reports	50.0%	50.0%				
Recommended reading	written exam in theory Basic literature	10.0% 50.0% 1. Szatkowski, Cichosz Metody numeryczne, Wydawnictwo PG, 20 2. Fortuna, Macukow, Wąsowski Metody numeryczne. Wydawnictwo					
	Supplementary literature	 Naukowo-Techniczne, 1995. Press, Teukolsky, Vetterling, Flannery Numerical Recipes The Art of Scientific Computing, Cambridge University Press, 2007. 					
	eResources addresses	2. Materials provided by the teacher. Metody numeryczne - Moodle ID: 22592 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=22592					

Example issues/ example questions/ tasks being completed	List and discuss the main sources of numerical errors in computation.
	Compare the methods of integrating functions of one variable: quadrature with fixed nodes and Newton- Cotes quadrature.
	Discuss the Gauss quadrature method.
	Compare the methods for numerically solving nonlinear equations of functions of one variable.
	Discuss Lagrange interpolation.
	Discuss Newton's interpolation.
	Discuss the mean square approximation.
	Discuss the trigonometric approximation. For which classes of functions can it be applied?
	Discuss the Monte Carlo method applied to the calculation of the definite integral of functions of one and many variables.
Work placement	Not applicable