

SDAŃSK UNIVERSITY 的 OF TECHNOLOGY

Subject card

Numerical Methods, PG_00047626							
Automatic Control, Cybernetics and Robotics							
		Academic year of realisation of subject			2023/2024		
first-cycle studies		Subject group			Optional subject group Subject group related to scientific research in the field of study		
Full-time studies		Mode of delivery			at the university		
3		Language of instruction			Polish		
5		ECTS credits			2.0		
general academic profile		Assessment form			exam		
Department of Decision Systems and Robotics -> Faculty of Electronics, Telecommunications and Informatics							
Subject supervisor		mgr inż. Sebastian Dziedziewicz					
Teachers	mgr inż. Sebastian Dziedziewicz						
Lesson type	Lecture	Tutorial	Laboratory	Project	t	Seminar	SUM
Number of study hours	15.0	0.0	0.0	0.0		0.0	15
Learning activity	classes included in study		Participation in consultation hours		Self-study		SUM
Number of study hours	15		2.0		33.0		50
Learning modern numerical algorithms necessary to solve many engineering problems.							
Course outcome Subject outcome					Method of verification		
Learning outcomes Course outcome [K6_U04] can apply knowledge of programming methods and techniques as well as select and apply appropriate programming methods and tools in computer software development or programming devices or controllers using microprocessors or programmable elements or systems specific to the field of study [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 [K6_W01] Knows and understands, to an advanced extent, mathematics necessary to formulate and solve simple issues		Student is able to implement numerical methods algorithms. Student is able to assess the correctness of numerical algorithms.			[SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools		
		mathematical problems and choose appropriate numerical methods to solve them. Student is able to use external sources when solving numerical problems.			[SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject [SW1] Assessment of factual knowledge		
	Automatic Control, Cy October 2021 first-cycle studies Full-time studies 3 5 general academic pro Department of Decision Informatics Subject supervisor Teachers Lesson type Number of study hours E-learning hours inclu Learning nours inclu Learning activity Number of study hours E-learning modern num Course outo [K6_U04] can apply A programming method techniques as well as apply appropriate pro methods and tools in software developmer programming devices controllers using mici or programmable ele systems specific to th study [K6_U01] can apply r knowledge to formula complex and non-typ related to the field of perform tasks, in an i way, in not entirely pr conditions, by:n- app selection of sources a information obtained assessment, critical a synthesis of this infor selection ad applica appropriate methodss [K6_W01] Knows and understands, to an an extent, mathematics formulate and solve se	Automatic Control, Cybernetics and October 2021 first-cycle studies Full-time studies 3 5 general academic profile Department of Decision Systems an Informatics Subject supervisor Teachers Lesson type Lesson type Lesson type Lesson type Learning hours included: 0.0 Learning activity Number of study hours E-learning modern numerical algorithm Course outcome [K6_U04] can apply knowledge of programming methods and techniques as well as select and apply appropriate programming methods and tools in computer software development or programming devices or controllers using microprocessors or programmable elements or systems specific to the field of study [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 [K6_W01] Knows and understands, to an advanced extent, mathematics necessary to	Automatic Control, Cybernetics and Robotics October 2021 Accademic y realisation first-cycle studies Subject gro Full-time studies Mode of de Language Language Language E Language E Subject supervisor Department of Decision Systems and Robotics -> Informatics Subject supervisor Department of Decision Systems and Robotics -> Informatics Subject supervisor Teachers Mode of de Lecture Tutorial Number of study hours Learning hours included: Learning notics included in study plan Number of study hours Learning modern numerical algorithms necessary t Course outcome Subj (K6_U04] can apply knowledge of programming methods and techniques as well as select and apply appropriate programming methods and non-typical problems related to the field of study [K6_U01] can apply mathematical knowledge to formulate and solve complex and non-typical problems related to the field of study [K6_U01] Can apply mathematical knowledge to formulate and solve complex and non-typical problems related to the field of study [K6_U01] Knows and understands, to an advanced extent, mathematics necessary to [K6_W01] Knows and understands, to an advanced extent, mathematics necessary to [K6_W01] Knows and understands, to an advanced extent, mathematics necessary to [K6_W01] Knows and understands, to an advanced extent, mathematics necessary to [K6_W01] Knows and understands, to an advanced extent, mathematics necessary to [K6_W01] Knows and understands, to an advanced extent, mathematics necessary to [K6_W01] Knows and [K6_W0	Automatic Control, Cybernetics and Robotics October 2021 Academic year of realisation of subject first-cycle studies Subject group Full-time studies Mode of delivery 3 Language of instruction 5 ECTS credits general academic profile Assessment form Department of Decision Systems and Robotics -> Faculty of Elec Informatics mgr in2. Sebastian Dziedzie Subject supervisor mgr in2. Sebastian Dziedzie Teachers mgr in2. Sebastian Dziedzie Lesson type Lecture Tutorial Learning nours included: 0.0 0.0 Learning nours included: 0.0 2.0 Learning modern numerical algorithms necessary to solve many efform tax6, in an inovative ynaming methods and techniques as well as select and apply appropriate programming methods and tools in computer software development or programmable elements or systems specific to the field of study and perform tax6, in an inovative way, in not entirely predictable conditions, by:n- appropriate solve complex and non-typical problems and chools in computer software development or programmable elements or systems specific to the field of study and perform tax6, in an inovative way, in not entirely predictable conditions, by:n- appropriate solve comportate numerical angorithms. Reference Student is able to analyze mathematical problems and chools in gapropriate numeri	Automatic Control, Cybernetics and Robotics October 2021 Academic year of realisation of subject first-cycle studies Subject group Full-time studies Mode of delivery 3 Language of instruction 5 ECTS credits general academic profile Assessment form Department of Decision Systems and Robotics -> Faculty of Electronics, Informatics mgr in2. Sebastian Dziedziewicz Subject supervisor mgr in2. Sebastian Dziedziewicz Teachers mgr in2. Sebastian Dziedziewicz Learning hours included: 0.0 0.0 0.0 Learning nours included: 0.0 Learning nours included: 0.0 E-learning hours included: 0.0 Learning modern numerical algorithms necessary to solve many engineer Student is able to implement numerical methods and tools in computer software development or programming methods and tools in computer software development or programmable elements or systems specific to the field of study and perform tasks, in an innovative way, in not entirely predictable complex and non-typical problems and choose appropriate numerical methods and tools in computer software development or programmable elements or systems specific to the field of study and perform tasks, in an innovative way, in not entirely predictable conse soft or mumerical methods and tools in computer software development or programmable elements or systems specific to the field of study and perform tasks, in an innovative way, in not entirely pr	Automatic Control, Cybernetics and Robotics October 2021 Academic year of realisation of subject 2023/ first-cycle studies Subject group Option first-cycle studies Mode of delivery at the 3 Language of instruction Polish 5 ECTS credits 2.0 general academic profile Assessment form exam Department of Decision Systems and Robotics -> Faculty of Electronics, Teleco Informatics Subject supervisor mgr in2. Sebastian Dziedziewicz reachers Teachers mgr in2. Sebastian Dziedziewicz Electure Learning nours included: 0.0 0.0 0.0 0.0 Learning nours included: 0.0 2.0 33.0 Learning nours included: 0.0 2.0 33.0 Learning modern numerical algorithms necessary to solve many engineering pro Course outcome Student is able to implement numerical methods algorithms. Student is able to saves the correctness of numerical algorithms. Student is able to saves the correctness of numerical methods and tools in computer software development or programmable elements or systems specific to the field of study and in the field of study and in the field of study and information of augropriate methods and tools in computer software development or solving numerical problems and non-typical problems showing numerical pro	Automatic Control, Cybernetics and Robotics October 2021 Academic year of realisation of subject 2023/2024 October 2021 Subject group Optional subject group relative to the field Subject group relative to the field Full-time studies Mode of delivery at the university 3 Language of instruction Polish 5 ECTS credits 2.0 general academic profile Assessment form exam Department of Decision Systems and Robotics -> Faculty of Electronics, Telecommunication Informatics Subject supervisor mgr in2. Sebastian Dziedziewicz Teachers mgr in2. Sebastian Dziedziewicz Seminar Number of study 15.0 0.0 0.0 0.0 Number of study 15.0 0.0 0.0 0.0 0.0 Number of study 15 2.0 33.0 Isal 2.0 33.0 Isal 2.0 Subject supervise Method of version and the onitical algorithms necessary to solve many engineering problems. Student is able to analyze information (SU4) Assessment or systems specific to the field of study and programming methods and tools in computers of numerical algorithms. Student is able to analyze information (SU4) Assessment or systems specific to the field of study and spropriate methods and tools on correlative supror

Subject contents	 Numbers representation, errors, numerical stability. Solution of linear algebraic equations: Gauss elimination. LU factorization, Cholesky factorization, the matrix inverse, vector and matrix norms, matrix condition number. Solution of linear algebraic equations using iterative methods: Gauss-Seidel method. Solution of nonlinear equations: iterative method, bisection method, linear interpolation method. Solution of systems of nonlinear equations: Newton-Raphson method, secant method. Optimization. Finding optima using golden-section search and parabolic interpolation. LQR optimal control. Approximation. Linear and nonlinear regression. Least squares method. Interpolation. Newton and Lagrange polynomials. Splines and piecewise interpolation. Numerical integration of functions. Romberg method. Gauss quadrature. Numerical differentiation, ordinary and partial derivatives. Solution of ordinary differential equations: Euler's method, Heun's method, midpoint method. Solution of systems of ordinary differential equations: adaptive methods. Stiff systems. Equations and systems of differential equations: boundary-value problems. Finite-difference method. 					
Prerequisites and co-requisites						
Assessment methods	Subject passing criteria	Passing threshold	Percentage of the final grade			
and criteria	Exam	50.0%	100.0%			
Recommended reading	Basic literature	 Anthony Ralston, A First Course in Numerical Analysis, 2nd edition, Dover Publications, 2001. Numerical Recipes in C, Second Edition (1992), http://http://www.nrbook.com/a/bookcpdf.php. Steven C. Chapra, Applied Numerical Methods with MATLAB for Engineers and Scientists, 2nd edition, McGraw-Hill, 2006. 				
	Supplementary literature					
	eResources addresses	Adresy na platformie eNauczanie: Metody numeryczne w AiR - Moodle ID: 34088 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=34088				
Example issues/ example questions/ tasks being completed	Determine the upper triangular matrix in the given system of linear equations. Give the result after 2 iterations of the Euler method for a given ordinary differential equation.					
Work placement	Not applicable					