



Subject card

Subject name and code	Numerical Methods & Optimization in Automatic Control, PG_00067429						
Field of study	Automatic Control, Cybernetics and Robotics						
Date of commencement of studies	October 2026	Academic year of realisation of subject			2027/2028		
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	3	ECTS credits			2.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Department of Signals and Systems -> Faculty of Electronics Telecommunications and Informatics -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr Krzysztof Topolski				
	Teachers		dr Krzysztof Topolski				
Lesson types	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		2.0		18.0	50
Subject objectives	To familiarize students with the theoretical foundations of mathematical optimization methods for unconstrained and constrained problems. Furthermore, they will be introduced to computational analytical and numerical methods.						
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 static optimization.		[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		Can formulate an optimization problem in mathematical form and solve it using analytical or numerical methods.		[SU1] Assessment of task fulfilment		

Subject contents	Course content – lecture 1. Introduction. Basic problems and terminology. Applications. 2. Mathematical notation of practical optimization problems. 3. Analytical methods for solving multivariable optimization problems without constraints. 4. Analytical methods for solving multivariable optimization problems with constraints. 5. Review of numerical methods for solving optimization problems: a) gradient-free direct search methods; b) gradient-free algorithms for improvement directions; c) simple gradient methods (without directional minimization); d) gradient algorithms for improvement directions.		
	Course content – laboratory 1. Mastering the computational environment (e.g., Matlab) 2. Implementing gradient and gradientless algorithms for finding the minimum of a function: Hooke-Jeeves algorithm, Symplex algorithm: Sample tasks: determining object model parameters based on a recorded step response. 3. Formulating the minimum of a function for constrained and unconstrained problems: Sample task: numerical tuning of PID controllers		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	sprawdzian pisemny	50.0%	50.0%
	wykonanie wszystkich zadań	50.0%	50.0%
Recommended reading	Basic literature	J.Seidler, A.Badach, W.Molisz, Metody rozwiązywania zadań optymalizacji, Podręczniki Akademickie eit, WNT 1980. A.Stachurski, Wprowadzenie do optymalizacji, Politechnika Warszawska, 2009.	
	Supplementary literature	J.Nocedal, S.J.Wright, Numerical Optimization, Springer, 1999	
	eResources addresses		
Example issues/ example questions/ tasks being completed			
Practical activities within the subject	Not applicable		

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