GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Optimization Methods, PG_00038273		
Field of study	Automation, Robotics and Control Systems		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2026/2027
Education level	second-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	Part-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	1	ECTS credits	5.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Control Engineering -> Faculty of Electrical and Control Engineering -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. Anna Witkowska	
	Teachers	dr hab. Anna Witkowska	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	10.0	10.0	0.0	50

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	50	5.0	70.0	125

Subject objectives

The aim of the course is to familiarise with the methods of optimization and preparation for self problem solving in the field of optimization by using various computer tools.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W14] has knowledge of mathematical modelling, identification, optimisation, decision suport decision-making and control, knows methods of implementing advanced control algorithms in industrial equipment	The student knows the analytical and numerical algorithms for solving optimization; able to define the objective function, decision variables, constraints and boundary conditions.	[SW1] Assessment of factual knowledge
[K7_K06] is aware of the impact of engineering activities on the quality of applied solutions and the environment	The student knows and is able to select an appropriate method and algorithm to solve the optimization problem for advanced problems in engineering practice	[SK5] Assessment of ability to solve problems that arise in practice
[K7_U07] is able to use analytical, simulation and experimental methods to formulate and solve engineering tasks and simple research problems in the field of automation and robotics	The student knows and is able to select an appropriate method and algorithm optimization for advanced problems in engineering practice	[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

<table>
<tr><td>Subject contents</td><td>Course content – lecture
Optimization basics, repetytory range of degree studies. Dekomposition problems in linear and nonlinear aspects. Problems of discrete programming: integer, binary and mixed. Dekompsition methods for solving linear programming problems. Algorithms for a large array of issues rare. Gradient directions of the improvement in linear programming. Penalty function method. Dynamic Optimization: Continuous Bellman optimality principle, the principle of maximum Pontriagin. NP-problems: Cycles and Hamiltonian path. Seeking solutions to issues multipurpose optimization. Issues multilevel optimization problem. Problems of scheduling processes. Special modern optimization methods.

Complex optimization problems. Rules modeling optimization problems. Building computational models of large issues. Decomposition of linear models. Studies of convergence of methods and rules for the selection method.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Optimization and support of decision making</td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>practical exercises</td><td>60.0%</td><td>30.0%</td></tr>
<tr><td>project</td><td>60.0%</td><td>30.0%</td></tr>
<tr><td>exam</td><td>60.0%</td><td>40.0%</td></tr>
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<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>1. A. Stachurski, A. Wierzbicki, Podstawy optymalizacji, Oficyna Wydawnicza PW, Warszawa 1999.
2. K. Amborski, Podstawy metod optymalizacji, Oficyna Wydawnicza Politechniki Warszawskiej.
3. M. Brdyś, A. Ruszczyński, Metody optymalizacji w zadaniach, Wydawnictwa Naukowo-Techniczne, Warszawa 1985.
4. Seidler J., Badach A., Molisz W.: Metody rozwiązywania zadań optymalizacji, WNT, Warszawa 1980.
5. Korbut A.: Programowanie dyskretne, PWN, Warszawa 1974.
6. Arabas G.: Wyklad z algorytmow ewolucyjnych, PWN, Warszawa 2003.</td></tr>
<tr><td>Supplementary literature</td><td>1. W. Findeisen, J. Szymanowski, A. Wierzbicki, Teoria i metody obliczeniowe optymalizacji, Państwowe Wydawnictwo Naukowe, Warszawa 1977.</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
</table>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td>• Determination of the optimal path of graph
• Determination of the maximum of unimodal.
• Decomposition of optimization tasks on the timeline
• Optimization tasks of objects that may operate in different regimes</td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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