GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Optimization and Decision Support, PG_00056863		
Field of study	Automation, Robotics and Control Systems		
Date of commencement of studies	October 2020	Academic year of realisation of subject	2021/2022
Education level	first-cycle studies	Subject group	
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	5.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Control Engineering -> Faculty of Electrical and Control Engineering		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. Anna Witkowska	
	Teachers	dr hab. Anna Witkowska	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	24.0	6.0	0.0	0.0	60

E-learning hours included: 0.0

OPTYMALIZACJA I WSPOMAGANIE DECYZJI [2021/22] -[4sem] - Moodle ID: 20848
https://enauczanie.pg.edu.pl/moodle/course/view.php?id=20848

Additional information:
Laboratory- stationary

Lecture and excercise - online

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	60	8.0	57.0	125

Subject objectives

The aim of the course is to acquaint students with the basics of the theory of optimization and decision support and preparation for independent solving basic optimization problems.

Learning outcomes

Course outcome	Subject outcome	Method of verification
K6_K05	Based on the analysis of the optimization problem, it can classify and then formulate the optimization task, define target functions, decision variables and constraints. Evaluates and properly interprets the solution received.	[SK5] Assessment of ability to solve problems that arise in practice
K6_W01	He knows and has a basic knowledge of analytical and numerical algorithms for solving basic tasks of linear and nonlinear optimization.	[SW1] Assessment of factual knowledge
K6_U05	He can choose and apply the appropriate method and algorithm to solve the task optimization for advanced problems in engineering practice (eg to choose the parameters of the regulator, allocate forces to an excess set of executive devices, determine the production volume that maximizes profit, minimize losses, to solve the transport problem and allocation).	[SU1] Assessment of task fulfilment

Subject contents	1. The concept of optimization, classification of optimization tasks. Examples of applications. 2. Formulation of a linear programming problem ZPL. Graphic method of ZPL solutions. 3. Primary and dual task, the economic interpretation of the dual problem, the standard form of ZPL. 4. Canonical form of a linear programming problem. The base solution. 5. Theorems basic of Simplex . The algorithm of the method. 6. Simplex method, sensitivity of solution. 7. The issue of non-linear programming without constrains. 8. Nonlinear optimization problem with constraints in the form of equality - the method of Lagrange multipliers. 9,10. Nonlinear optimization with constraints in the form of inequality - Kuhn-Tucker method. 11. Numerical methods to search optimization task. 12. Nawaday optimization methods. The method of genetic algorithms. Artificial neural networks. 13. Functionals. Dynamic optimization. 14,15. Complex optimization problems in automation systems.
Prerequisites and co-requisites	Ability mathematical description of physical and technical processes. Knowledge of basic mathematic differential theory.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
excercises	50.0%	40.0%
labolatory	50.0%	20.0%
lecture	50.0%	40.0%

Recommended reading

Basic literature	• A. Stachurski, A. Wierzbicki, Podstawy optymalizacji, Oficyna Wydawnicza PW, Warszawa 1999. • K. Amborski, Podstawy metod optymalizacji, Oficyna Wydawnicza Politechniki Warszawskiej. • M. Brdyś, A. Ruszczyński, Metody optymalizacji w zadaniach, Wydawnictwa Naukowo-Techniczne, Warszawa 1985. • Seidler J., Badach A., Molisz W.: Metody rozwiązywania zadań optymalizacji, WNT, Warszawa 1980. • Korbut A.: Programowanie dyskretne, PWN, Warszawa 1974. • Arabas G.: Wyklad z algorytmow ewolucyjnych, PWN, Warszawa 2003.
Supplementary literature	• W. Findeisen, J. Szymanowski, A. Wierzbicki, *Teoria i metody obliczeniowe optymalizacji*, Państwowe Wydawnictwo Naukowe, Warszawa 1977. • Garfinkiel R. S.,Nemhauser G. I.: Programowanie całkowitoliczbowe, PWN, Warszawa 1978 • Findaisen W.: Wielopoziomowe uklady sterowania, PWN, Warszawa 1978
eResources addresses	

Example issues/ example questions/ tasks being completed	Example 1. The electrical nodes there are receivers receiving currents shown on the drawing. How do I connect (which segments of he electrical web) the final receivers from the supply point to minimise the voltage drop between them Example2. The company produces two products: W1 and W2 of three materials: S1, S2 and S3. For manufacturing of the product W1 needs 2 units of S1, one unit of S2 , and 4 units of S3. To produce a product W2 respectively needs 2 units of S1 , 2 units of S2. Daily limit is: 14 units of S1, 8 - S2 and 16 - S3. Product prices are as follows: 2 zł for W1 and 3 zł for W2. Find the production plan to maximize the benefits from the sale by using graphical method.
Work placement	Not applicable