GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Operational Research with Elements of Graph Theory, PG_00056158		
Field of study	Transport and Logistics		
Date of commencement of studies	October 2021	Academic year of realisation of subject	2022/2023
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	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Institute of Ocean Engineering and Ship Technology -> Faculty of Mechanical Engineering and Ship Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Rafał Szłapczyński	
	Teachers	dr hab. inż. Rafał Szłapczyński	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	30.0	0.0	0.0	45

E-learning hours included: 0.0

Address on the e-learning platform: https://enauczanie.pg.edu.pl/moodle/course/admin.php?courseid=16337

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	25.0	75

Subject objectives

Familiarising students with basic problems of operation's research and graph theory as well as with methods of solving those problems.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U03] can use computer-aided design, production and operation tools for means and systems of transport	A student identifies a problem, selects appropriate method and software tool and successfully uses them when working on a project	[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools
[K6_W04] has a basic knowledge in IT, electronics, automation and control, computer graphics useful to understand the possibilities of their application in transport	A student identifies a problem, selects appropriate method and software tool, applies them to solve the problem and finally assesses and interprets obtained solution.	[SW1] Assessment of factual knowledge

<table>
<tr><td>Subject contents</td><td>1. Linear programming: graphic method - introduction to the Simplex algorithm
2. Simplex algorithm in one-criteria optimisation (Excel, Excel-Solver)
3. Simplex algorithm in one-criteria optimisation (Matlab)
4. Simplex algorithm sensivity analysis (Matlab)
5. Transportation problems (Excel, Excel - Solver): closed transportation problem and open transportation problem
6. Transportation problems (Excel, Excel - Solver): transportation-production task, minimizing empty runs
7. Network programming - CPM (MS Project)
8. Network programming - CPM Cost (MS Project)
9. Network programming - PERT (MS Project)
10. Multi-criteria optimization ranking methods (Matlab)
11. Elements of queuing theory (Excel, Matlab)
12. Elements of graph theory: breadth-first and depth-first algorithms, graph consistency (Matlab)
13. Elements of graph theory: Dijkstra algorithm for finding shortest path in a graph without negative lengths of the edges
14. Elements of graph theory: Bellman-Ford algorithm for finding shortest path (Matlab)
15. Nearest neighbour algorithm for solving the traveling salesman problem (Matlab)</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Mathematics, Information technologies and basic programming skills: Transport studies programme,</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>Own work during laboratory classes</td><td>50.0%</td><td>50.0%</td></tr><tr><td>Marks received on 2 tests</td><td>50.0%</td><td>50.0%</td></tr></table></td></tr>
<tr><td>Recommended reading</td><td><table><tr><td>Basic literature</td><td>1. Badania operacyjne w przykładach i zadaniach (red. naukowa: Karol Kukuła), PWN
2. Wprowadzenie do teorii grafów, Robin J. Wilson, PWN</td></tr><tr><td>Supplementary literature</td><td>1. Badania operacyjne, Wojciech Sikora, Polskie Wydawnictwo Ekonomiczne
2. Optymalizacja dyskretna. Modele i metody kolorowania grafów, Marek Kubale i innni, WNT</td></tr><tr><td>eResources addresses</td><td>Adresy na platformie eNauczanie:
Badania operacyjne z elementami teorii grafów, W, TiL(sem. 3) zimowy 22/23 (PG_00056158) - Moodle ID: 25915
https://enauczanie.pg.edu.pl/moodle/course/view.php?id=25915</td></tr></table></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>Tasks 1-15 from the subject lsit.</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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