GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Operational Research with Elements of Graph Theory, PG_00045215		
Field of study	Transport and Logistics, Transport and Logistics		
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	3	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Marine Mechatronics -> Faculty of Ocean 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						
	Adresy na platformie eNauczanie: Badania operacyjne z elementami teorii grafów, W, TiL(sem. 3) zimowy 21/22 (PG_00045215) - Moodle ID: 14518 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=14518						

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_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 (from the topics list), selects an appropriate method and an IT tool and successfully applies them when working on a project.	[SW1] Assessment of factual knowledge
	K6_U03	A student identifies a problem (from the topics list), selects an appropriate method and an IT tool, applies them to solve the problem and finally assesses and interprets the obtained solution.	[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information

Subject contents	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)
Prerequisites and co-requisites	Mathematics, Information technologies and basic programming skills: Transport studies programme,

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Own work during laboratory classes	50.0%	50.0%
	Marks received on three tests	50.0%	50.0%

Recommended reading	Basic literature	1. Badania operacyjne w przykładach i zadaniach (red. naukowa: Karol Kukuła), PWN 2. Wprowadzenie do teorii grafów, Robin J. Wilson, PWN
	Supplementary literature	1. Badania operacyjne, Wojciech Sikora, Polskie Wydawnictwo Ekonomiczne 2. Optymalizacja dyskretna. Modele i metody kolorowania grafów, Marek Kubale i innni, WNT
	eResources addresses	Badania operacyjne z elementami teorii grafów, W, TiL(sem. 3) zimowy 21/22 (PG_00045215) - Moodle ID: 14518 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=14518

Example issues/ example questions/ tasks being completed	Tasks 1-15 from the subject lsit.
Work placement	Not applicable