GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Operational Research, PG_00060652		
Field of study	Transport and Logistics		
Date of commencement of studies	October 2023	Academic year of realisation of subject	2024/2025
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	4	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Division of Applied Computer Science -> Institute of Naval Architecture -> 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	0.0	30.0	0.0	45
	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	45	4.0	51.0	100

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 well established knowledge in the field of computer science, electronics, automation and control, information technology and computer graphics, useful for understanding the possibilities of applying them in transport	Student has basic knowledge regarding operation's research and is able to use it for solving optimization and decision problems in transport.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
[K6_U03] is able to use computer methods to support the design, development and operation of transport means and systems	Student can use software tools to solve operation's research problems.	[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 [SU5] Assessment of ability to present the results of task
[K6_K03] understands non-technical aspects and effects of activity in the profession of an engineer and its impact on the environment; is aware of the responsibility for decisions made	Student is aware of the responsibility for the decision they make.	[SK2] Assessment of progress of work
[K6_U05] can formulate a simple engineering task and its specification in the field of design, maintenance and operation of transport means and systems	Student is able to define and solve a linnear optimziation problem using the methods from the course.	[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 [SU5] Assessment of ability to present the results of task

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 (Python)
4. Simplex algorithm sensivity analysis (Python)
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 (Python)
11. Elements of queuing theory (Excel, Python)
12. Elements of graph theory: breadth-first and depth-first algorithms, graph consistency (Python)
13. Elements of graph theory: Dijkstra algorithm for finding shortest path in a graph without negative lengths of the edges (Python)
14. Elements of graph theory: Bellman-Ford algorithm for finding shortest path (Python)
15. Nearest neighbour algorithm for solving the traveling salesman problem (Python)

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
Marks received on 2 tests	50.0%	50.0%
Own work during laboratory classes	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	Adresy na platformie eNauczanie: Badania operacyjne W, TiL(sem. 4) letni 24/25 (PG_00060652) - Moodle ID: 30702 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=30702

Example issues/ example questions/ tasks being completed

Tasks 1-15 from the subject lsit.

Work placement

Not applicable

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