Subject card

Subject name and code	Operations research and numerical methods, PG_00044577
Field of study	Transport

Date of commencement of studies	October 2020	Academic year of realisation of subject	2021/2022
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	4.0
Learning profile	general academic profile	Assessment form	exam

Conducting unit	Department of Railway Engineering -> Faculty of Civil and Environmental Engineering

Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Zbigniew Kędra
	Teachers	dr inż. Michał Urbaniak
		dr inż. Karol Winkelmann
		mgr inż. Łukasz Jeliński
		dr inż. Zbigniew Kędra
		prof. dr hab. inż. Jarosław Górski

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	15.0	15.0	0.0	0.0	60
	E-learning hours included: 0.0						
	Adresy na platformie eNauczanie:						

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	5.0	35.0	100

Subject objectives	The aim of the course is to familiarize students with the basic issues related to the subject of operations research and numerical methods

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_W01] has basic knowledge of mathematical analysis, algebra, calculus of probability and operational research required for describing and solving transport problems	The student has basic knowledge of operations research and numerical methods necessary to solve problems in transport	[SW1] Assessment of factual knowledge
	[K6_U06] able to plan and conduct simple laboratory and operational experiments and simulations in the area of transport; able to interpret the results and formulate conclusions	The student is able to independently solve the tasks related to the optimization of transport problems. Is able to solve problems using the known numerical methods.	[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU1] Assessment of task fulfilment

Subject contents	Introduction to operating researches. Building of decission model. Linear programming. Graphic method and simpleks. Dual task. Degeneracy of solutions. Forwarding question. Discreet optimization. Method of division and limitations. Basic notions and definitions of theory of vice - count. Network programming. Method CPM and PERT. The analysis in respect of time - cost. Interpolation and aproksymacja. Integration. Solving non - linear equations. Solving differential equations and arrangements of such equations.
Prerequisites and co-requisites	Mathematics

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Lecture - exam	50.0%	30.0%
	Exercise	50.0%	25.0%
	Laboratory	50.0%	20.0%
	Lecture - exam	50.0%	10.0%
	Laboratory	50.0%	5.0%
	Exercise	50.0%	10.0%

Recommended reading	Basic literature	1. Jędrzejczyk Z., Kukuła K. i inni: Badania operacyjne. PWN, Warszawa 1996. 2. Kosma Z. Metody numeryczne dla zastosowań inżynierskich. Politechnika Radomska, Radom 2006. 3. Sikora W.: Badania operacyjne. Polskie Wydawnictwo Ekonomiczne, Warszawa 2008. 4. Steven C. Chapra, Raymond P. Canale: Numerical methods for engineers. McGraw-Hill Book Company 1998.
	Supplementary literature	1. Gass S.: Programowanie liniowe. PWN, Warszawa 1980. 2. Runka H.: Programowanie matematyczne. Część I Programowanie liniowe. AE Poznań 1997. 3. Tadeusiewicz R. Sieci neuronowe. Warszawa : Akademicka Oficyna Wydaw. RM, 1993.
	eResources addresses	

Example issues/ example questions/ tasks being completed	
Work placement	Not applicable