GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	MODELLING OF TRANSPORT PROCESSES, PG_00045922		
Field of study	Transport		
Date of commencement of studies	February 2023	Academic year of realisation of subject	2022/2023
Education level	second-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	1	Language of instruction	Polish
Semester of study	1	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Transportation Engineering -> Faculty of Civil and Environmental Engineering		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Jacek Oskarbski	
	Teachers	dr inż. Aleksandra Romanowska dr hab. inż. Jacek Oskarbski	

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

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	10.0	45.0	100

Subject objectives

Solving transport issues with the use of methods of graph theory, queuing theory, computer simulations, mobile automats. Modelling and dependencies on the traffic flow of vehicles. Basic characteristics of random distributions of variables used in the description of the traffic process. Functions of probability density used to describe the distribution of selected parameters in the vehicle stream (free and nonfree traffic). Traffic as a stochastic process, non-stationary.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W09] has basic knowledge of modelling of trips and vehicle traffic, traffic and transport forecasts adapted to the specific needs of city and region	Using graph theory to model transport networks Application of models for the division of transport tasks and traffic distribution models in the transport network Selection of tools for the analysis and evaluation of the transport system depending on the type of model used	[SW1] Assessment of factual knowledge
[K7_U05] able to apply an extended mathematical apparatus, mathematical models and computer simulations to describe complex technical processes in transport, model the relations which occur in transport and analyse, design and assess the operation of transport systems	Selection of tools for the analysis and evaluation of the transport system depending on the type of model used	[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools
[K7_W03] has broad knowledge of modelling transport processes, including the knowledge required to describe and assess how selected elements of the transport system operate	Solving issues related to the modelling of transport processes with the use of methods of mass handling systems	[SW1] Assessment of factual knowledge

Subject contents	Transport system models. Arrangement of streams in transport networks. Surrounding the transport system. Forecasting the development of transport systems. Dynamics of transport processes. Definitions: mass handling system, railway network, transport network, transport process. Graphical representation of the transport network. Classification of mass handling systems. Operating disciplines. Division of railway systems. Non-branded handling systems. Transport process models - elements of the model, structure, traffic flows. Simulation models. Modelling and dependencies on the traffic flow of vehicles. Basic characteristics of random distributions of variables used in the description of the traffic process. Functions of probability density used to describe the distribution of selected parameters in the vehicle stream (free and nonfree traffic). Traffic as a stochastic, non-stationary process. Macroscopic and mesoscopic motion models - hydrodynamic analogy, wave model of motion, diffusion models (Pacey, Payne, Robertson, model with rectangular distribution of vehicle driving time), LWR model, Daganzo cellular model, cellular machines, event-based models. Microscopic models - driving models behind the leader (e.g. classic, stimulus response, psycho-spacing, fuzzy logic, psycho-phisical, Pipes linear, Bando, Gipps, SmartPath Simulation), lane change models, models of joining the traffic. Models of travel formation. Spatial distribution models. Models of division of transport tasks. Models of traffic distribution in the transport network. Packets of programs for modelling traffic in macro, meso and microscopic view.
Prerequisites and co-requisites	Knowledge of subjects transport systems, Traffic engineering

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
tutorials	90.0%	40.0%
written exam	60.0%	60.0%

Recommended reading

Basic literature	1. Gniadenko B. W., Kowalenko I. N.: Wstęp do teorii obsługi masowej. PWN, Warszawa 1971. 2. Koźniewska I., Włodarczyk M.: Modele odnowy, niezawodności i masowej obsługi. PWN, Warszawa 1978. 3. Leszczyński J. Modelowanie systemów i procesów transportowych, Oficyna wydawnicza Politechniki Warszawskiej, 1999. 4.Sienkiewicz P.: Inżynieria systemów. MON, Warszawa 1983. 5. Smalko Z.: Modelowanie eksploatacyjnych systemów transportowych. ITE, Radom 1996. 6. Woropay M., Knopik L., Landowski B.: Modelowanie procesów eksploatacji w systemie transportowym. Biblioteka Problemów Eksploatacji. ITE, Bydgoszcz-Radom 2001.
Supplementary literature	Jacyna M.: Modele wielokryterialne w zastosowaniu do oceny systemów transportowych.Wyd.Pol.Warszawskiej, Warszawa 2002.
eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed	General methodology of model construction. The concept of the model, model properties and model classification. Aim and scope of modeling of transport and logistics systems and processes. Basic concepts, purpose of modeling, classification of tasks, construction of the model.Stages of model construction. Modelling of traffic flows. Modeling of movement in networks. Graphic representation of the system and transport process. Graphic representation of the transport network. Models of the transport system environment - the demand for transport and its division. Stochastic character of transport processes. Methods of mass service theory in modelling of transport processes. Classification of mass handling systems. Disciplines of service. Division of railway systems. Methods and models of railway systems. Traffic flow and characteristics related to it. General assumptions. Traffic flow on the road. Traffic flow in the transport network. Conditions imposed on the traffic flow moved along elements of the structure of the transport network. Models of distribution of streams in the transport network - transport costs, traffic congestion, distribution of streams of minimal cost and distribution of equilibrium, linear and non-linear model. Models of a transport system with the use of methods of cellular automats - elements of the model, structure, neighbours, traffic rules, examples of applications. Transport process models - process dynamics, process phase network structure, process implementation trajectories, simulation of transport processes, monte carlo method. Markov models of transport processes with the use of methods of the theory of queues. Birth and death process. Non-branded models of transport processes with the use of methods of the theory of queues, simulation methods. The issue of congestion - loss of notification.
Work placement	Not applicable