

## 。 GDAŃSK UNIVERSITY OF TECHNOLOGY

## Subject card

Subject name and code	Operational Research, PG_00054278								
Field of study	Informatics								
Date of commencement of studies	February 2025		Academic year of realisation of subject			2024/2025			
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			3.0			
Learning profile	general academic profile		Assessment form			exam			
Conducting unit	Department of Algorithms and Systems Modelling -> Faculty of Electronics, Telecommunications and Informatics								
Name and surname	Subject supervisor		prof. dr hab. inż. Krzysztof Giaro						
of lecturer (lecturers)	Teachers		prof. dr hab. inż. Krzysztof Giaro						
			dr Paweł Obszarski						
			prof. dr hab. inż. Michał Pióro						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Projec	t	Seminar	SUM	
	Number of study hours	30.0	15.0	0.0	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		5.0		25.0		75	
Subject objectives	Student will be able t Student will be able t	to model and ar	nalyse simple o Diement linear	queueing syste programming ı	ms with model.	a stoch	astic arrival p	proces.	
	Students will know basic techniques and methods for constructing timetables in basic models of deterministic task scheduling.								

[K7_U07] can apply advanced methods of process and function support, specific to the field of studyStudent can match a stochastic model of a queuing system to its operational description.[SU1] Assessment of task fulfilment[K7_U01] can apply mathematical knowledge to formulate and solve complex and non-typical problems related to the field of study by: - appropriate selection of source information and its critical analysis, synthesis, creative interpretation and presentation, - application of appropriate methods and toolsThe student is able to apply mathematical methods to analyze the stochastic behavior of the queuing system with a given structure and parameters.[SU1] Assessment of task fulfilment[K7_W01] knows and understrande, to an increasedThe student is able to model a material problems and tools[SW3] Assessment of know contribution work and protection of appropriate and protection	ledge d						
[K7_U01] can apply mathematical knowledge to formulate and solve complex and non-typical problems related to the field of study by: - 	edge d						
[K7_W01] knows and understande, to an increased The student is able to model a contained in written work as	ledge Id						
extent, mathematics to the extent necessary to formulate and solve complex issues related to the field of study							
[K7_U02] can perform tasks related to the field of study as well as formulate and solve problems applying recent knowledge of physics and other areas of scienceThe student knows the classifications of scheduling problems and algorithms for optimal scheduling.[SU1] Assessment of task fulfilment							
Subject contents Components, characteristics, and classification of queuing systems, the problem of stability.	Components, characteristics, and classification of queuing systems, the problem of stability.						
Construction of queuing processes: number of requests in system, unfinished work.	Construction of queuing processes: number of requests in system, unfinished work.						
System delays, Little's law, flow conservation equation for work-conserving systems.	System delays, Little's law, flow conservation equation for work-conserving systems.						
Statistical evaluation of service demand over a given observation period.	Statistical evaluation of service demand over a given observation period.						
Types of request arrival processes and service time distributions.	Types of request arrival processes and service time distributions.						
Performance evaluation of computer and multiterminal systems based on mean offered load.	Performance evaluation of computer and multiterminal systems based on mean offered load.						
Birth and death process and the M/M/1 system.	Birth and death process and the M/M/1 system.						
Generalized birth and death processes and practical models of Markovian queuing systems: Erlang for impact of processors aggregation and buffer sharing, impatient requests.	Generalized birth and death processes and practical models of Markovian queuing systems: Erlang formula, impact of processors aggregation and buffer sharing, impatient requests.						
Definition of linear programming	Definition of linear programming						
Applications of linear programming	Applications of linear programming						
Simplex method	Simplex method						
Elements of integer programming	Elements of integer programming						
3-field notation in task scheduling	3-field notation in task scheduling						
Project managment	Project managment						
Scheduling on parallel machinges	Scheduling on parallel machinges						
Scheduling on dedicated machines	Scheduling on dedicated machines						

Prerequisites and co-requisites	Fundamentals of:							
	- linear algebra							
	- theory of computing							
	- discrete mathematics							
	- probability and statistics							
Assessment methods	Subject passing criteria	Passing threshold	Percentage of the final grade					
and criteria	Final test, task scheduling	52.0%	33.0%					
	Final test, linear programming	52.0%	33.0%					
	Final test, queueing systems	52.0%	34.0%					
Recommended reading	Basic literature	Brucker P., Scheduling Algorithms, Springer, 2007.						
		L. Kleinrock: Queuing systems, vol. I, J. Wiley 1975						
		Błażewicz J., Cellary W., Słowiński R., Węglarz J., Badania operacyjne dla informatyków, WNT, Warszawa, 1983.						
		Joti Lal Jain, W. Boehm, Sri Gopal Mohanty: A Course on Queuing Models, Chapman & Hall 2006						
	Supplementary literature	Judin D.E, Golsztejn E.G., Metody programowania liniowego, WNT 1964.						
		Taha H. A. Operations research : an introduction, Upper Saddle River:						
		Hiller F. Liberman G, Introduction to operations research, McGraw-Hill, 2010.						
		T. Czachórski: Modele kolejkowe w ocenie efektywności sieci i systemów komputerowych, Wyd. J. Skalmierski, Gliwice 1999						
		B. Filipowicz: Modele stochastyczne w badaniach operacyjnych. Analiza i synteza systemów obsługi i sieci kolejkowych, WNT, Warszawa 1996						
		W. Oniszczuk , Modele algorytmy kolejkowe i strategie obsługi w systemach komputerowych, Wyd. Politechniki Białostockiej 2009.						
	eResources addresses	Adresy na platformie eNauczanie:						
Example issues/ example questions/ tasks being completed								
Work placement	Not applicable							

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