GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Operational Research, PG_00054278		
Field of study	Informatics		
Date of commencement of studies	February 2024	Academic year of realisation of subject	2023/2024
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 of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Krzysztof Giaro	
	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	Project	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 to model and analyse simple queueing systems with a stochastic arrival proces. Student will be able to apply and implement linear programming model. Students will know basic techniques and methods for constructing timetables in basic models of deterministic task scheduling.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U07] can apply advanced methods of process and function support, specific to the field of study	Student can match a stochastic model of a queuing system to its operational description.	[SU1] Assessment of task fulfilment
[K7_U05] can plan and conduct experiments related to the field of study, including computer simulations and measurements; interpret obtained results and draw conclusions	The student is able to analyze the basic characteristics of the queuing system according to the 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:n- appropriate selection of source information and its critical analysis, synthesis, creative interpretation and presentation,n- application of appropriate methods and toolsn	The 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_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 science	The student knows the classifications of scheduling problems and algorithms for optimal scheduling.	[SU1] Assessment of task fulfilment
[K7_W01] Knows and understands, to an increased extent, mathematics to the extent necessary to formulate and solve complex issues related to the field of study.	The student is able to model a practical problem as a linear programming and determine its optimal solution.	[SW3] Assessment of knowledge contained in written work and projects

Subject contents	Components, characteristics, and classification of queuing systems, the problem of stability. Construction of queuing processes: number of requests in system, unfinished work. System delays, Little's law, flow conservation equation for work-conserving systems. Statistical evaluation of service demand over a given observation period. Types of request arrival processes and service time distributions. Performance evaluation of computer and multiterminal systems based on mean offered load. Birth and death process and the M/M/1 system. 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 Applications of linear programming Simplex method Elements of integer programming 3-field notation in task scheduling Project managment Scheduling on parallel machinges Scheduling on dedicated machines
Prerequisites and co-requisites	Fundamentals of: - linear algebra, - theory of computing - discrete mathematics - probability and statistics
Assessment methods and criteria	

Subject passing criteria	Passing threshold	Percentage of the final grade
Final test, queueing systems	52.0%	34.0%
Final test, linear programming	52.0%	33.0%
Final test, task scheduling	52.0%	33.0%

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: Person Pretince Hall, cop. 2007 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	