GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Operational Research, PG_00064506		
Field of study	Informatics		
Date of commencement of studies	February 2026	Academic year of realisation of subject	2025/2026
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	English
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 -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Krzysztof Giaro	
	Teachers	prof. dr hab. inż. Krzysztof Giaro dr Paweł Obszarski dr inż. Robert Ostrowski 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	9.0	21.0	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_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
[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 tools	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

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

<table>
<tr><td>Prerequisites and co-requisites</td><td>Fundamentals of:

- linear algebra,

- theory of computing

- discrete mathematics

- probability and statistics</td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Reported solutions of exercises</td><td>52.0%</td><td>34.0%</td></tr>
<tr><td>Final test, task scheduling</td><td>52.0%</td><td>33.0%</td></tr>
<tr><td>Final test, linear programming</td><td>52.0%</td><td>33.0%</td></tr>
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</td></tr>
<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>Brucker P., Scheduling Algorithms, Springer, 2007.

L. Kleinrock: Queuing systems, vol. I, J. Wiley 1975

Joti Lal Jain, W. Boehm, Sri Gopal Mohanty: A Course on Queuing Models, Chapman & Hall 2006

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.</td></tr>
<tr><td>Supplementary literature</td><td>Judin D.E, Golsztejn E.G., Metody programowania liniowego, WNT 1964.

Błażewicz J., Cellary W., Słowiński R., Węglarz J., Badania operacyjne dla informatyków, WNT, Warszawa, 1983.

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.</td></tr>
<tr><td>eResources addresses</td><td>Adresy na platformie eNauczanie:</td></tr>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td></td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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