GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

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| Subject name and code | Operational Research, PG_00054278 | | |
| Field of study | Informatics | | |
| 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<br>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<br>dr Paweł Obszarski<br>prof. dr hab. inż. Michał Pióro | |

| Lesson types and methods of instruction | Lesson type | Lecture | Tutorial | Laboratory | Project | Seminar | SUM |
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| | 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 |
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| | Number of study hours | 45 | 5.0 | 25.0 | 75 |

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| Subject objectives | Student will be able to model and analyse simple queueing systems with a stochastic arrival proces.<br><br>Student will be able to apply and implement linear programming model.<br><br>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 |
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| | [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_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_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_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_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 |

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

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

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| Recommended reading | Basic literature | Brucker P., Scheduling Algorithms, Springer, 2007.<br><br>L. Kleinrock: Queuing systems, vol. I, J. Wiley 1975<br><br>Błażewicz J., Cellary W., Słowiński R., Węglarz J., Badania operacyjne dla informatyków, WNT, Warszawa, 1983.<br><br>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.<br><br>Taha H. A. Operations research : an introduction, Upper Saddle River: Person Pretince Hall, cop. 2007<br><br>Hiller F. Liberman G, Introduction to operations research, McGraw-Hill, 2010.<br><br>T. Czachórski: Modele kolejkowe w ocenie efektywności sieci i systemów komputerowych, Wyd. J. Skalmierski, Gliwice 1999<br><br>B. Filipowicz: Modele stochastyczne w badaniach operacyjnych. Analiza i synteza systemów obsługi i sieci kolejkowych, WNT, Warszawa 1996<br><br>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 | |