GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

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|---|---|---|---|
| Subject name and code | Monitoring and Diagnosis in Control Systems, PG_00038292 | | |
| Field of study | Automation, Robotics and Control Systems | | |
| Date of commencement of studies | October 2025 | Academic year of realisation of subject | 2025/2026 |
| Education level | second-cycle studies | Subject group | Specialty subject group<br>Subject group related to scientific research in the field of study |
| Mode of study | Part-time studies | Mode of delivery | at the university |
| Year of study | 1 | Language of instruction | Polish |
| Semester of study | 2 | ECTS credits | 4.0 |
| Learning profile | general academic profile | Assessment form | exam |
| Conducting unit | Faculty Of Electrical And Control Engineering -> Wydziały Politechniki Gdańskiej | | |
| Name and surname of lecturer (lecturers) | Subject supervisor | dr hab. inż. Michał Grochowski | |
| | Teachers | | |

**Lesson types and methods of instruction**

| Lesson type | Lecture | Tutorial | Laboratory | Project | Seminar | SUM |
|---|---|---|---|---|---|---|
| Number of study hours | 20.0 | 0.0 | 20.0 | 0.0 | 0.0 | 40 |

E-learning hours included: 0.0

Adresy na platformie eNauczanie:

**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 | 40 | 10.0 | 50.0 | 100 |

**Subject objectives**

Gain knowledge related with data driven monitoring and diagnosis system within the area of control systems. The use of computational intelligence methods to build diagnostic models. Learn how to properly use known methods for the design and implementation of basic diagnostic systems.

**Learning outcomes**

| Course outcome | Subject outcome | Method of verification |
|---|---|---|
| [K7_U05] is able to select equipment and take electrical measurements, is able to use ICT information and communication technology to carry out engineering tasks involving devices, systems and automation and robotics systems | Selects appropriate information and communication techniques for the implementation of diagnostic systems. | [SU4] Assessment of ability to use methods and tools<br>[SU2] Assessment of ability to analyse information |
| [K7_K06] is aware of the impact of engineering activities on the quality of applied solutions and the environment | Not related to the subject of the course. | [SK5] Assessment of ability to solve problems that arise in practice |
| [K7_W05] has knowledge of artificial intelligence computing techniques, inference, learning and solution-finding methods in algorithmic terms applied to automation and robotics systems | Designs and implements simple diagnostic systems. He uses selected methods of computational intelligence in the projects. He uses the software tool: Matlab/Simulink at an advanced level. On the basis of the conducted research, he knows how to draw conclusions. | [SW3] Assessment of knowledge contained in written work and projects |
| [K7_U10] is able to apply the known mathematical tools and methods and computer techniques to analyse and evaluate automation and robotics components, devices, systems and systems | Designs and implements simple diagnostic systems. On the basis of the conducted research, the student is able to draw conclusions. | [SU4] Assessment of ability to use methods and tools<br>[SU1] Assessment of task fulfilment |

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| Subject contents | Data acquisition systems in control systems. Data processing. Process monitoring and diagnosis. Data driven models in process diagnosis. Multivariable Processes Analysis. Computational intelligence methods. Actuators and measuring devices fault diagnosis. Early fault and anomalies detection systems. Fault tolerance control systems. |
| Prerequisites and co-requisites | Knowledge of the following subjects: Mathematics, Numerical Methods, optimization and decision making, Methods of artificial intelligence, the Methods and basis of identification and Modeling and identification |

**Assessment methods and criteria**

| Subject passing criteria | Passing threshold | Percentage of the final grade |
|---|---|---|
| Exam | 50.0% | 40.0% |
| Lecture test | 50.0% | 20.0% |
| Laboratory | 50.0% | 40.0% |

**Recommended reading**

Basic literature

1. Bishop C. M. Pattern Recognition and Machine Learning. Springer, 2006.
2. Byrski, W. Obserwacja i sterowanie w systemach dynamicznych. Uczelniane Wydawnictwa NaukowoDydaktyczne Akademii GórniczoHutniczej w Krakowie, 2007.
3. Jackson, J.E., A User's Guide to Principal Components, Wiley-Interscience (New York), 1991.
4. Korbicz, J., Kościelny, J, Kowalczuk, Z., Cholewa, W. Diagnostyka procesów. Modele, metody sztucznej inteligencji, zastosowania. Wydawnictwa Naukowo Techniczne, Warszawa 2002.
5. Korbicz J., Kościelny J.M. Modelowanie, diagnostyka i sterowanie nadrzędne procesami. Implementacja w systemie DiaSter. Wydawnictwa Naukowo Techniczne, Warszawa 2009.

Supplementary literature

1. Alpaydin, E. Introduction to Machine Learning. The MIT Press Cambridge, Massachusetts London, England 2010.
2. Berthold, M. Hand, D. J. Intelligent data analysis, an intruduction. Springer, 1999.
3. Bishop C. M. Neural Networks for Pattern Recognition. Oxford University Press, New York 1995.
4. Haykin, S. Neural Networks. A Comprehensive Foundation, Prentice Hall, 1999.
5. Venkatasubramanian, V., Rengaswamy, R., Kavuri, S.N. and Yin, K., A review of process fault detection and diagnosis Part I, Part II, Part I: Computers and Chemical Engineering 27, 2003.

eResources addresses

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|---|---|
| Example issues/ example questions/ tasks being completed | - Describe in detail the algorithm for building the PCA model and explain how it is used for process diagnosis.- List and describe the steps in the process of diagnosis using data-driven methods. Give any example illustrating another of these steps.- Sketch and briefly describe the essence of support vector machines (SVMs). Highlight the support vectors in the figure.- What effect(s) can we expect when we use PCA models to diagnose strongly nonlinear processes ? |
| Work placement | Not applicable |

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