GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Monitoring and Diagnosis in Control Systems, PG_00069094		
Field of study	Automation, Robotics and Control Systems		
Date of commencement of studies	February 2026	Academic year of realisation of subject	2026/2027
Education level	second-cycle studies	Subject group	
Mode of study	Full-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	Department of Intelligent and Decision Support Systems -> Faculty of Electrical and Control Engineering -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Michał Grochowski	
	Teachers	dr hab. inż. Michał Grochowski	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	15.0	15.0	0.0	60

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	60	10.0	30.0	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_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. Based on the conducted tests, is able to draw conclusions.	[SU4] Assessment of ability to use methods and tools
[K7_K06] is aware of the impact of engineering activities on the quality of applied solutions and the environment	Student is aware that the quality of designed monitoring and diagnostic systems affects the safety, reliability, and efficiency of devices and installations, and consequently the safety of users and technological processes.	[SK4] Assessment of communication skills, including language correctness
[K7_W05] has knowledge of artificial intelligence computing techniques, inference, learning and solution-finding methods in algorithmic terms applied to automation and robotics systems	For the purposes of developing diagnostic systems, student applies selected methods of computational intelligence. He/ She uses tool software such as Matlab/Simulink at an advanced level.	[SW3] Assessment of knowledge contained in written work and projects
[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	Is able to use information and communication technologies (ICT), including Matlab/Simulink and data acquisition environments, for signal analysis, diagnostic data processing, and designing system condition monitoring algorithms.	[SU4] Assessment of ability to use methods and tools

<table>
<tr><td>Subject contents</td><td>Course content – lecture
Data acquisition systems in control systems.
Processing of measurement information.
Monitoring and diagnostic technologies for processes.
Use of data-driven models for process diagnostics.
Multivariate statistical analysis.
Computational intelligence methods.
Diagnostics of actuators and measurement devices.
Early detection of system failures/dysfunctions.
Fault-tolerant control systems.
Digital twins.

Course content – laboratory
Designing and analysis of PCA models
Engine fault detection using PCA
Clustering and its use in diagnostics
Engine fault detection and classification using neural networks
Face detection and recognition

Course content – project
Development of a diagnostic and decision-support system for a selected object/process using computational technologies and methods from the machine learning family.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Knowledge from the following subjects: Mathematics, Numerical Methods, Optimization and Decision-Making, Artificial Intelligence Methods, Methods and Fundamentals of Identification, Modelling and Identification.</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>Project</td><td>50.0%</td><td>25.0%</td></tr>
<tr><td>Lboratory</td><td>50.0%</td><td>25.0%</td></tr>
<tr><td>Lecture</td><td>50.0%</td><td>50.0%</td></tr>
</table></td></tr>
<tr><td>Recommended reading</td><td><table>
<tr><td>Basic literature</td><td>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.</td></tr>
<tr><td>Supplementary literature</td><td>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.</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
</table></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>Designing of a PCA model for diagnostic purposes

Use of artificial neural network models for diagnostic purposes

Use of computational intelligence techniques for detecting abnormal states</td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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