GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Optical systems for automatic diagnostics and process monitoring, PG_00062774		
Field of study	Technologies for Industry 5.0		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2027/2028
Education level	first-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	3	Language of instruction	Polish
Semester of study	6	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department Of Metrology And Optoelectronics -> Faculty Of Electronics Telecommunications And Informatics -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Robert Bogdanowicz	
	Teachers		

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	15.0	15.0	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	50.0	100

Subject objectives

The aim of the course is to acquire basic knowledge of optical monitoring and diagnostic methods in industrial systems. Students will learn to use optical methods to build diagnostic systems. In addition, the aim is to acquire the ability to correctly use the learned methods to design and implement basic diagnostic systems adapted to industry.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U02] identifies and solves problems related to signal processing and transmission, integrates measurement and control systems, manages electronic systems in the context of intelligent production processes	The student has a working knowledge of technological processes and monitoring tools using optical techniques.	[SU4] Assessment of ability to use methods and tools
[K6_K03] effectively, clearly and unambiguously conveys information, describes activities and communicates their results and opinions of a specialist engineer using appropriate communication methods and tools	The student interprets the phenomena occurring during optical diagnostics of a technological process and processes taking place in the life cycle of optical devices and systems, critically evaluates the functioning of existing solutions in the field of optical systems for automatic diagnostics and monitoring of industrial processes.	[SK3] Assessment of ability to organize work
[K6_W05] demonstrates practical knowledge related to technological processes, utilized devices and systems, has knowledge regarding selected processes monitoring tools	Student is able to deal with measurement errors and implement calibration and validation techniques. Communicates effectively, clearly and unambiguously, describes activities and communicates the results and opinions of the specialist engineer, using appropriate communication methods and tools, taking into account the specificities of optical solutions.	[SW1] Assessment of factual knowledge

<table>
<tr><td>Subject contents</td><td colspan="3">1, Measuring techniquesBasic measurement parameters obtained using optical methodsImportance and application in industry.2 Spectroscopy IIntroduction to spectroscopy.Near-infrared (NIR), mid-infrared (MIR), Raman spectroscopy,Applications and significance.3 Spectroscopy IIMultiple linear regression (MLR).Fluorescence spectroscopy.UV/Vis spectroscopy.Comparison and applications.Interpretation and applications.4 Vision optical methodsVision systemsImage processing techniques.Pattern recognition in an industrial context.5 Measurement errors and uncertaintyCommon sources of error.Calibration and validation.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td colspan="3"></td></tr>
<tr><td>Assessment methods and criteria</td><td colspan="3"><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Lecture</td><td>50.0%</td><td>40.0%</td></tr>
<tr><td>Laboratory</td><td>50.0%</td><td>40.0%</td></tr>
<tr><td>Project</td><td>59.0%</td><td>20.0%</td></tr>
</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td colspan="2">T. Pustelny: Physical and technical aspects of optoelectronic sensors, Wyd. Polit. Śląska, Gliwice 2005 Z. Kaczmarek: Światłowodowe czujniki i przetworniki pomiarowe (Optical fibre sensors and transducers), Publishing House PAK, Warsaw 2006Bishop C. M. Pattern Recognition and Machine Learning. Springer, 2006.Byrski, W. Observation and control in dynamic systems. Uczelniane Wydawnictwa Naukowo Dydaktyczne Akademii Górniczo Hutniczej w Krakowie, 2007.Jackson, J.E., A User's Guide to Principal Components, Wiley-Interscience (New York), 1991.Korbicz, J., Kościelny, J, Kowalczuk, Z., Cholewa, W. Process Diagnostics. Models, methods of artificial intelligence, applications. Wydawnictwa Naukowo Techniczne, Warszawa 2002.Korbicz J., Kościelny J.M. Modelling, diagnostics and master control of processes. Implementation in the DiaSter system. Wydawnictwa Naukowo Techniczne, Warszawa 2009.</td></tr>
<tr><td>Supplementary literature</td><td colspan="2">Alpaydin, E. Introduction to Machine Learning. The MIT Press Cambridge, Massachusetts London, England 2010.

Berthold, M. Hand, D. J. Intelligent data analysis, an intruduction. Springer, 1999.

Bishop C. M. Neural Networks for Pattern Recognition. Oxford University Press, New York 1995.

Haykin, S. Neural Networks. A Comprehensive Foundation, Prentice Hall, 1999.

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 colspan="2">Adresy na platformie eNauczanie:</td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="3">n/a</td></tr>
<tr><td>Work placement</td><td colspan="3">Not applicable</td></tr>
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