



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 2026	Academic year of realisation of subject				2028/2029	
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	Metrology and Electronic Systems Department -> Faculty of Electronics Telecommunications and Informatics -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Robert Bogdanowicz					
	Teachers						
Lesson types	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_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	
	[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_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	

Subject contents	<p>Course content – lecture</p> <p>1, Measuring techniques Basic measurement parameters obtained using optical methods Importance and application in industry. 2 Spectroscopy I Introduction to spectroscopy. Near-infrared (NIR), mid-infrared (MIR), Raman spectroscopy, Applications and significance. 3 Spectroscopy II Multiple linear regression (MLR). Fluorescence spectroscopy. UV/Vis spectroscopy. Comparison and applications. Interpretation and applications. 4 Vision optical methods Vision systems Image processing techniques. Pattern recognition in an industrial context. 5 Measurement errors and uncertainty Common sources of error. Calibration and validation.</p>														
Prerequisites and co-requisites															
Assessment methods and criteria	<table border="1"> <thead> <tr> <th data-bbox="456 533 794 562">Subject passing criteria</th> <th data-bbox="799 533 1137 562">Passing threshold</th> <th data-bbox="1142 533 1481 562">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="456 568 794 598">Project</td> <td data-bbox="799 568 1137 598">59.0%</td> <td data-bbox="1142 568 1481 598">20.0%</td> </tr> <tr> <td data-bbox="456 604 794 633">Laboratory</td> <td data-bbox="799 604 1137 633">50.0%</td> <td data-bbox="1142 604 1481 633">40.0%</td> </tr> <tr> <td data-bbox="456 640 794 669">Lecture</td> <td data-bbox="799 640 1137 669">50.0%</td> <td data-bbox="1142 640 1481 669">40.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Project	59.0%	20.0%	Laboratory	50.0%	40.0%	Lecture	50.0%	40.0%
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Recommended reading	Basic literature	<p>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 2006 Bishop 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., Kowalczyk, 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.</p>													
	Supplementary literature	<p>Alpaydin, E. Introduction to Machine Learning. The MIT Press Cambridge, Massachusetts London, England 2010.</p> <p>Berthold, M. Hand, D. J. Intelligent data analysis, an introduction. Springer, 1999.</p> <p>Bishop C. M. Neural Networks for Pattern Recognition. Oxford University Press, New York 1995.</p> <p>Haykin, S. Neural Networks. A Comprehensive Foundation, Prentice Hall, 1999.</p> <p>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.</p>													
Example issues/ example questions/ tasks being completed	n/a														
Practical activities within the subject	Not applicable														

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