



## Subject card

Subject name and code	Intelligent Measurement Systems, PG_00048473						
Field of study	Automatic Control, Cybernetics and Robotics						
Date of commencement of studies	February 2023	Academic year of realisation of subject			2023/2024		
Education level	second-cycle studies	Subject group			Optional subject group 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	2	ECTS credits			2.0		
Learning profile	general academic profile	Assessment form			exam		
Conducting unit	Department of Decision Systems and Robotics -> Faculty of Electronics, Telecommunications and Informatics						
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Jakub Wszolek					
	Teachers	dr inż. Jakub Wszolek					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	0.0	15.0	0.0	30
	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	30		4.0		16.0	50
Subject objectives	The aim of the course is to acquaint students with methods of building a smart computer measuring systems. The student becomes familiar with the interfaces used widely in automation of measurement. The course design students use the acquired knowledge in practice. The projects relate to actual implementation of the measurement system.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_U21] can individually carry out an in-depth analysis of controlling, diagnostics and signal processing problems; and, to an advanced extent, is able to individually design, tune and operate automatic regulation, control and robotics systems; and use computers to control and monitor dynamic systems	The student has the ability to analyze the results of the project. Student is able to assess the legitimacy of choosing a specific group of algorithms.	[SU3] Assessment of ability to use knowledge gained from the subject
	[K7_U03] can design, according to required specifications, and make a complex device, facility, system or carry out a process, specific to the field of study, using suitable methods, techniques, tools and materials, following engineering standards and norms, applying technologies specific to the field of study and experience gained in the professional engineering environment	Student designs and implements his own measurement and diagnostic system.	[SU4] Assessment of ability to use methods and tools
	K7_U04	The student is introduced to available tools and development libraries. Ready-to-use cloud services (AWS, GCP) for integration with metering systems (MQTT) are also presented. Performance analysis of distributed queuing systems is performed.	[SU3] Assessment of ability to use knowledge gained from the subject
	[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.	Student uses machine learning to solve prediction and classification problems in measurement systems.	[SW2] Assessment of knowledge contained in presentation
	[K7_W03] Knows and understands, to an increased extent, the construction and operating principles of components and systems related to the field of study, including theories, methods and complex relationships between them and selected specific issues - appropriate for the curriculum.	Student describes problems related to the construction of distributed measurement systems.  Student understands the mechanism of aggregation and analysis of measurement data.  The student has knowledge of components included in the architecture of the intelligent measuring system.	[SW2] Assessment of knowledge contained in presentation
Subject contents	<p>1. Introduction 2. The configuration and structure of the measuring system 3. Accuracy of measurement and dynamic measurement systems 4. Noise generated within the measuring devices 5. Interference generated in the measuring line 6. The computer measurement systems a. The architecture of the machine b. Bus and rail c. The bus Universal Serial Bus USB and IEEE-1394 7. Components measuring systems a. Structure of computerized measuring system b. Digital-to-analog and analog-to-digital c. Measurement systems interfaced. Computer measurement cards and virtual instruments 8. Scattered wired measurement systems a. The CAN interface i. General, bus, messages ii. The structure of the CAN module and. Characteristics of the system and protocol PROFIBUS-DP b. System Interface PROFIBUS c. The interface MicoLAN 9. Measuring systems in the network a. Network Ethernet b. The IEEE 802.11 wireless network 10. Measurement systems on the LAN a. Measuring systems on an Ethernet network interface converters b. Measuring systems on the LAN as an interface c. Measuring systems on the Internet 11. The system architecture aggregating measurement data a. Database as a reservoir for storing data and. TCP / IP stack i. The data link and physical layer network and. the relational model ii. Model nierelacyjny iii. hierarchical model 12. Methods of measurement data mining</p>		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	lecture	50.0%	60.0%
	project	50.0%	40.0%
Recommended reading	Basic literature	• Measurement Systems, Ernest Doebelin, 2019	

	Supplementary literature	<ul style="list-style-type: none"> <li>• <a href="http://www.jboss.org/get-started/">http://www.jboss.org/get-started/</a></li> <li>• <a href="http://playground.arduino.cc/Code/WebClient">http://playground.arduino.cc/Code/WebClient</a></li> <li>• <a href="http://www.dropwizard.io/">http://www.dropwizard.io/</a></li> <li>• <a href="https://www.arduino.cc/en/Guide/HomePage">https://www.arduino.cc/en/Guide/HomePage</a></li> </ul>
	eResources addresses	Adresy na platformie eNauczenie: Inteligentne Systemy Pomiarowe - Moodle ID: 34861 <a href="https://enauczanie.pg.edu.pl/moodle/course/view.php?id=34861">https://enauczanie.pg.edu.pl/moodle/course/view.php?id=34861</a>
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	