



## Subject card

Subject name and code	Automation and Control, PG_00055387						
Field of study	Mechanical Engineering						
Date of commencement of studies	October 2021		Academic year of realisation of subject		2022/2023		
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	2		Language of instruction		Polish		
Semester of study	4		ECTS credits		5.0		
Learning profile	general academic profile		Assessment form		exam		
Conducting unit	Department of Mechanics and Mechatronics -> Faculty of Mechanical Engineering and Ship Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Rafał Hein				
	Teachers		dr hab. inż. Rafał Hein				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	15.0	15.0	0.0	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		5.0		60.0	125
Subject objectives	Presentation of the fundamental issues related to automatic control systems. Knowing the structure and components of a typical control system. Gaining general information about the methods of designing, analysis and study of the properties of typical control systems.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K6_U03] is able to identify, formulate and develop the documentation of a simple design or technological task, including the description of the results of this task in Polish or in a foreign language and to present the results using computer software or other aiding tools		Student is able to build, design and analyze basic automatic control systems with the typical, universal industrial controllers.		[SU3] Assessment of ability to use knowledge gained from the subject		
	[K6_W06] possesses elementary knowledge on automatics and robotics of mechanical systems		Student knows the structure of a typical automation system and its components		[SW1] Assessment of factual knowledge		

Subject contents	Lectures		
	Introduction. Control system structure. Classification of control elements. Block diagrams and block diagram algebra. Classification of control systems. Open and closed loop feedback control systems. Properties of the feedback control systems. Mathematical description of signals and control systems. Laplace transformation and its application. The concept of transfer function. Static characteristics of automation systems. Dynamic time characteristics. Determination of step and impulse responses. Frequency analysis. Dynamic frequency characteristics. Drawing Nyquist and Bode charts. Basic components of control systems. Classification, description, characteristics and examples of typical control system components: proportional, integral, derivative, delay, first and second order systems. Controllers. PID controller - construction, structure, characteristics. Concept of stability. Stability of control systems. Conditions for stability. Algebraic (Hurwitz, Routh) and graphic (Nyquist) criteria of stability. Stability margin.		
	Tutorials		
	Application of the Laplace transform in solving differential equations. Signals description in the time domain and determination of their Laplace transform. Determination of transfer function for systems with different physical nature. Rules and block diagram reduction. Determination of time responses of systems with a given transfer function. Preparation of frequency characteristics of Bode and Nyquist. Research on the stability of control systems based on algebraic (Hurwitz, Routh) and graphical (Nyquist) criteria. Determining of stability margin. Choice of the type and parameters of the controller . Designing and analysis of simple continuous control systems.		
Labs	Design and analysis of combinational logic systems. Simulation and analysis of control systems in the Matlab & Simulink package. Determination of static and dynamic (time and frequency) characteristics of selected physical systems. Investigation of temperature control system with PID controller. Investigation of electromechanical servomechanism.		
	Prerequisites and co-requisites		
	Mathematics, Physics, Mechanics		
	Assessment methods and criteria		
	Subject passing criteria	Passing threshold	Percentage of the final grade
	Laboratory (reports from laboratory exercises)	56.0%	30.0%
	Midterm colloquium	56.0%	30.0%
	Written exam	56.0%	40.0%
Recommended reading	Basic literature	1. Holejko D., Kościelny W., J.: Automatyka procesów ciągłych, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2012,  2. Mazurek J., Vogt H., Żydanowicz W.: Podstawy Automatyki, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2006,  3. Perycz S.: Podstawy automatyki. Skrypt PG. Gdańsk 1983,  4. Żelazny M.: Podstawy automatyki, PWN, Warszawa 1976,  5. Orlikowski C., Wittbrodt E.: Podstawy automatyki i sterowania. Laboratorium t.1, Gdańsk 1999.  6. Orlikowski C., Wittbrodt E.: Podstawy automatyki i sterowania. Laboratorium t.2, Gdańsk 2007.  7. Próchnicki W., Dzida M.: Podstawy automatyki. Zbiór zadań. Wyd. PG. Gdańsk 2004.	
	Supplementary literature	1. Kaczorek T.: Teoria układów regulacji automatycznej. WNT Warszawa 1974,  2. Morecki A., Knapczyk J.: Podstawy robotyki. Teoria i elementy manipulatorów i robotów. WNT. Warszawa 1993.	

	eResources addresses	Adresy na platformie eNauczenie: Automatyka i Sterowanie 2022/2023 - Moodle ID: 30206 <a href="https://enauczenie.pg.edu.pl/moodle/course/view.php?id=30206">https://enauczenie.pg.edu.pl/moodle/course/view.php?id=30206</a>
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	