



Subject card

Subject name and code	Control Theory - Laboratory, PG_00067979						
Field of study	Teoria sterowania - laboratorium						
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	5		ECTS credits		2.0		
Learning profile	general academic profile		Assessment form		assessment		
Conducting unit	Department of Signals and Systems -> Faculty of Electronics Telecommunications and Informatics -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Piotr Kaczmarek				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	0.0	0.0	15.0	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		2.0		18.0	50
Subject objectives	The aim of the course is to prepare students for the design, analysis, and practical implementation of control systems for real physical processes using classical and modern control theory methods. Students develop skills in system identification, controller selection and tuning, as well as stability and performance evaluation, both in simulation and in microcontroller-based implementation.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K6_U03] can design, according to required specifications, and make a simple 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		The student can design and implement control systems for linear and nonlinear plants using modern control theory methods.		[SU1] Ocena realizacji zadania		
	[K6_U12] can analyze the operation of components, circuits and systems related to the field of study, as well as measure their parameters and examine technical specifications, and plan and conduct experiments related to the field of study, including computer simulations and measurements, and interpret obtained results and draw conclusions		The student can analyze the stability of control systems and select controller parameters to ensure the required stability margin.		[SU1] Ocena realizacji zadania		

Subject contents	Course content – laboratory As part of the laboratory, students complete 57 tasks involving the practical design and implementation of control algorithms for real physical systems such as DC motors, thermal processes, and liquid-level systems, using Arduino, ESP32, or STM32 modules. Students model the systems, perform parameter identification, and prepare models that are then used to design an appropriate controller. The laboratory covers classical P, PI, and PID controllers, including tuning, noise filtering, and control-signal limitation. Advanced methods are also introduced, including state-space controllers, observers, and relay (on-off) control. The course additionally includes elements of robust control based on sliding-mode techniques, implemented on microcontroller platforms. Course content – project Each team carries out a project that begins with the identification of a selected physical system, such as a DC motor, thermal process, or water tank, based on experimental measurements. A key element of the project is the closed-loop simulation, where students test and analyze the systems behavior under different parameters and operating conditions. Based on the identified model, advanced control algorithms are developed, including state-feedback control, sliding-mode control, and optionally a state observer. After the simulation stage, students implement the chosen control algorithm on a microcontroller (e.g., Arduino, ESP32, STM32) and conduct practical experiments. The final outcome includes stability analysis, comparison of control strategies, as well as documentation and presentation of the obtained results and conclusions.		
Prerequisites and co-requisites	Knowledge of control principles within the scope of the courses: Fundamentals of Automation and Control Theory.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Project	60.0%	30.0%
	Lab tasks	60.0%	70.0%
Recommended reading	Basic literature	Katsuhiko Ogata Modern Control Engineering	
	Supplementary literature	K. J. Åström, R. M. Murray Feedback Systems, An Introduction for Scientists and Engineers	
	eResources addresses		
Example issues/ example questions/ tasks being completed			
Practical activities within the subject	Not applicable		

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