GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Fundamentals of Authomatics, PG_00064121		
Field of study	Mechanical and Medical Engineering		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2025/2026
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	3	ECTS credits	5.0
Learning profile	general academic profile	Assessment form	assessment
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		

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	4.0	61.0	125

Subject objectives

The aim of the study is to acquire knowledge about fundamental issues related to automatic control systems

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U04] is able to utilize empirical, analytical, simulation, and computer-based methods to formulate and solve engineering tasks in the field of medical and mechanical engineering	The student is able to use the knowledge acquired in the course to design and simulate basic control systems used in mechanical and medical engineering.	[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information
[K6_U06] can identify and formulate specifications for simple practical engineering tasks, and critically analyze existing technical solutions, evaluating their functionality, particularly in the context of designing mechanical and medical-mechanical devices	The student is able to design a control system used in mechanical-medical engineering systems and identify its parameters.	[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task
[K6_W04] has knowledge in automation and robotics of mechanical systems or electrical and electronic engineering or thermodynamics and fluid mechanics including bioreology	The student is able to analyze the operation of a control system and design a control system consisting of mechanical, electrical and electronic subsystems.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects [SW2] Assessment of knowledge contained in presentation

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 marigin. 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
Tutorials passing	50.0%	30.0%
Lecture passing	50.0%	40.0%
Labs passing	50.0%	30.0%

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	Kaczorek T.: Teoria układów regulacji automatycznej. WNT Warszawa 1974. Nagrath I.J., Gopal M.: Control Systems Engineering, 5th Edition, ANSHAN LTD, 2008

	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed	Design the control system to lift a hospital bed	
Work placement	Not applicable	

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