GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Essentials of Automatics, PG_00055418						
Field of study	Mechatronics						
Date of commencement of studies	October 2025		Academic year of realisation of subject	2026/2027			
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 -> Wydziały Politechniki Gdańskiej						
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		8.0	57.0		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_W10] has knowledge about development trends in the field of engineering and technology sciences and scientific disciplines: Mechanical Engineering, Automation, Electronics, Electrical Engineering and Space Technologies, adequate for Mechatronics curse	He knows the trends in the development of theoretical methods as well as practical technologies used in automation and control theory.	[SW1] Assessment of factual knowledge
[K6_U02] is able to elaborate on specific mechatronic topics as well as topics from engineering and technology sciences and disciplines such as Mechanical Engineering, Automation, Electronics, Electrical Engineering and Space Technologies	Student can distinguish between open and closed loop control system. He knows the basic concepts and nomenclature used to describe automation systems. Is able to develop and design an automation facility control system.	[SU1] Assessment of task fulfilment
[K6_W03] has organized and theoretically supported, advanced knowledge in the field of automation and control theory of stationary , continuous and discrete mechatronic systems, mechatronic design, developments and exploitation of mechatronic systems	Student has a fundamental knowledge about control systems. He knows the structure of a typical automation systems. He can describe signals and analyze them in the time and frequency domain. He is able to identify and characterize typical dynamic elements. He has practical skills to design and select the parameters of control systems.	[SW1] Assessment of factual knowledge
[K6_U04] is able to utilise known methods and mathematical models as well as analogue and digital measurement methods for analysing and assessment of stationary continuous and discrete mechatronics systems and processes	Student can identify the basic elements of control systems. He is able to design basic feedback control systems.	[SU1] Assessment of task fulfilment

Subject contents

Lecture

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. Signals. Standard signals. 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 marigin.

Classes

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 controller parameters. Designing and analysis of simple continuous control systems.

Laboratory

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
	Written exam	50.0%	40.0%
	Laboratory (reports from laboratory exercises)	100.0%	30.0%
	Midterm colloquium	50.0%	30.0%
Recommended reading	Basic literature	Nagrath I.J., Gopal M.: Control Systems Engineering, 5th Edition, ANSHAN LTD, 2008	
	Supplementary literature	1. Kaczorek T.: Teoria układów regulacji automatycznej. WNT Warszawa 1974.	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed			
Work placement	Not applicable		

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