GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Essentials of Automatics, PG_00050270		
Field of study	Mechatronics, Mechatronics		
Date of commencement of studies	October 2020	Academic year of realisation of subject	2021/2022
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	6.0	59.0	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_U09	Student knows and is able to use computer programs for analysis, modeling and simulation of control systems.	[SU1] Assessment of task fulfilment
K6_W10	General knowledge about the directions of development of automation and control theory.	[SW1] Assessment of factual knowledge
K6_W03	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

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	
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	