GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Fundamentals of authomatics, PG_00055747		
Field of study	Mechanical and Medical 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 None
Semester of study	3	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 dr inż. Wiktor Sieklicki	

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_W06] he/she has basic knowledge in the fields of automatics and mechanical system robotics or electrical engineering and electronics	Student can analyse the functioning of the given control system or design the simple control system related to the mechanical-medical area	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects
[K6_U07] he/she is able to identify the problem and list simple engineering tasks to solve this problem in practice, he/she is able to critically analyze the proposed technical solutions and conclude whether these solutions can be implemented to solve problems related to design of mechanical devices and mechanical-medical devices	Student can design and conduct parameters' identification of the system and control system related to the mechanical-medical area	[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_U05] he/she is able to use analytic and modelling methods to formulate and solve engineering tasks related to the mechanical-medical area	Student can use knowledge acquainted in this subject to design simple control system related to the mechanical-medical area	[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_U04] he/she is able to use basic medical apparatus and methods to assess measurement errors	Student can apply measurement technique and assess the errors of the measurement	[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

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
Labs passing	50.0%	30.0%
Lecture passing	50.0%	40.0%
Tutorials 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: Podstawy Automatyki_IMM_2022/23 - Moodle ID: 27129 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=27129
Example issues/ example questions/ tasks being completed	Design the control system to lift a hospital bed	
Work placement	Not applicable	

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