



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						
	Address on the e-learning platform: http:// Adresy na platformie eNauczanie:						
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	<p>Lecture</p> <p>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 margin.</p> <p>Classes</p> <p>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 margin. Choice of the type and controller parameters. Designing and analysis of simple continuous control systems.</p> <p>Laboratory</p> <p>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.</p>														
Prerequisites and co-requisites	Mathematics, Physics, Mechanics														
Assessment methods and criteria	<table border="1"> <thead> <tr> <th data-bbox="453 1079 794 1111">Subject passing criteria</th> <th data-bbox="799 1079 1141 1111">Passing threshold</th> <th data-bbox="1145 1079 1493 1111">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="453 1117 794 1149">Written exam</td> <td data-bbox="799 1117 1141 1149">50.0%</td> <td data-bbox="1145 1117 1493 1149">40.0%</td> </tr> <tr> <td data-bbox="453 1155 794 1187">Laboratory (reports from laboratory exercises)</td> <td data-bbox="799 1155 1141 1187">100.0%</td> <td data-bbox="1145 1155 1493 1187">30.0%</td> </tr> <tr> <td data-bbox="453 1193 794 1225">Midterm colloquium</td> <td data-bbox="799 1193 1141 1225">50.0%</td> <td data-bbox="1145 1193 1493 1225">30.0%</td> </tr> </tbody> </table>			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%
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Example issues/ example questions/ tasks being completed															
Work placement	Not applicable														