



Subject card

Subject name and code	Fundamentals of automatics, 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	<p>Lectures</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. 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>Tutorials</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 parameters of the controller. Designing and analysis of simple continuous control systems.</p> <p>Labs</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	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	<p>1. Holejko D., Kościelny W., J.: Automatyka procesów ciągłych, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2012,</p> <p>2. Mazurek J., Vogt H., Żydanowicz W.: Podstawy Automatyki, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2006,</p> <p>3. Perycz S.: Podstawy automatyki. Skrypt PG. Gdańsk 1983,</p> <p>4. Żelazny M.: Podstawy automatyki, PWN, Warszawa 1976,</p> <p>5. Orlikowski C., Wittbrodt E.: Podstawy automatyki i sterowania. Laboratorium t.1, Gdańsk 1999.</p> <p>6. Orlikowski C., Wittbrodt E.: Podstawy automatyki i sterowania. Laboratorium t.2, Gdańsk 2007.</p> <p>7. Próchnicki W., Dzida M.: Podstawy automatyki. Zbiór zadań. Wyd. PG. Gdańsk 2004.</p>
	Supplementary literature	<p>Kaczorek T.: Teoria układów regulacji automatycznej. WNT Warszawa 1974.</p> <p>Nagrath I.J., Gopal M.: Control Systems Engineering, 5th Edition, ANSHAN LTD, 2008</p>
	eResources addresses	<p>Adresy na platformie eNauczanie: Podstawy Automatyki_IMM_2022/23 - Moodle ID: 27129 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=27129</p>
Example issues/ example questions/ tasks being completed	Design the control system to lift a hospital bed	
Work placement	Not applicable	