

## § GDAŃSK UNIVERSITY § OF TECHNOLOGY

## Subject card

Biomedical Engineeri								
Biomedical Engineering								
October 2024		Academic year of realisation of subject			2025/2026			
first-cycle studies		Subject group			Obligatory subject group in the field of study			
Full-time studies		Mode of delivery			at the university			
2		Language of instruction			Polish			
3		ECTS credits			5.0			
general academic profile		Assessment form			exam			
Department of Biomedical Engineering -> Faculty of Electronics, Telecommunications and Informatics							matics	
Subject supervisor		dr inż. Grzegorz Jasiński						
Teachers	dr inż. Grzegorz Jasiński							
Lesson type	Lecture	Tutorial	Laboratory	Project		Seminar	SUM	
Number of study hours	30.0	0.0	30.0	0.0		0.0	60	
E-learning hours included: 0.0								
Learning activity	Participation in classes includ plan	ed in study		n Iours	Self-study SU		SUM	
Number of study hours	60	5.0		60.0 12		125		
The aim is to acquair basics of linear contro presented in the time issues of robotics and is to provide students	It students with ol systems and and frequency d robots, includ s with the knowl	the methods o static analysis domain, includ ing assemblies edge and abilit	of analysis the of of biomedical ding the stability and systems of ty to analyse pr	lynamic control s y analys of robots ocesses	system systems sis. Pres s, sensc s. of aut	is of automatic are presented sented are also ors and actuato tomatic control	control. The I. Analysis is fundamental ors. The aim	
Course out	come	Subj	ect outcome		Method of verification			
[K6_U08] while identifying and formulating specifications of engineering tasks related to the field of study and solving these tasks, can:n- apply analytical, simulation and experimental methods,n- notice their systemic and non-technical aspects,n-make a preliminary economic assessment of suggested solutions and engineering work n     [K6_W02] knows and understands, to an advanced extent, selected laws of physics and physical phenomena as well as methods and theories explaining the complex relationships between them, constituting the basic general knowledge in the field of technical sciences related to the field of study     [K6_W03] knows and understands, to an advanced extent, the construction and operating principles of components and systems related to the field of study.     [K6_W03] knows and understands, to an advanced extent, the construction and operating principles of components and systems related to the field of study.		Knowledge about automation blocks, stability criteria, feedback and robotics components			[SU3] Assessment of ability to use knowledge gained from the subject			
		Knowledge and understanding about automation blocks, stability criteria, feedback and robotics components			[SW1] Assessment of factual knowledge			
	October 2024     first-cycle studies     Full-time studies     2     3     general academic pro-     Department of Biome     Subject supervisor     Teachers     Lesson type     Number of study     hours     E-learning hours include     Learning activity     Number of study     hours     The aim is to acquair     basics of linear contropresented in the time     issues of robotics and     is to provide students     Course out     [K6_U08] while identif     formulating specific     engineering tasks re     field of study and sol     tasks, can:n- apply a     simulation and expel     methods,n- notice th     and non-technical as     make a preliminary e     assessment of sugg     solutions and engine     [K6_W02] knows and     understands, to an a     extent, selected laws     and physical phenom     as methods and the     components and systond the     theories, met	October 2024     first-cycle studies     Full-time studies     2     3     general academic profile     Department of Biomedical Engineeri     Subject supervisor     Teachers     Lesson type   Lecture     Number of study hours   30.0     E-learning hours inclued: 0.0     Learning activity   Participation in classes includ plan     Number of study hours   60     The aim is to acquaint students with basics of linear control systems and presented in the time and frequency issues of robotics and robots, includ is to provide students with the knowl     Course outcome   [K6_U08] while identifying and formulating specifications of engineering tasks related to the field of study and solving these tasks, can:n- apply analytical, simulation and experimental methods,n- notice their systemic and non-technical aspects,n- make a preliminary economic assessment of suggested solutions and engineering work n     [K6_W02] knows and understands, to an advanced extent, selected laws of physics and physical phenomena as well as methods and theories explaining the complex relationships between them, constituting the basic general knowledge in the field of technical sciences related to the field of study     [K6_W03] knows and understands, to an advanced extent, the construction and operating principles of components and systems related to the field of study, including theorise, methods and complex relationships between them and selected s	October 2024   Academic 1 realisation     first-cycle studies   Subject gro     Full-time studies   Mode of de     2   Language     3   ECTS cred     general academic profile   Assessmer     Department of Biomedical Engineering -> Faculty of     Subject supervisor   dr inż. Grzego     Teachers   dr inż. Grzego     Lesson type   Lecture     Number of study hours   30.0     Learning activity   Participation in didactic classes included in study plan     Number of study hours   60     Number of study hours   60     The aim is to acquaint students with the methods of basics of linear control systems and static analysis presented in the time and frequency domain, includ issues of robotics and robots, including assemblies is to provide students with the knowledge and abilit     Course outcome   Subj     [K6_U08] while identifying and formulating specifications of engineering tasks related to the field of study and solving these tasks, can:n- apply analytical, simulation and experimental methods,n- notice their systemic and non-technical aspects,n- make a preliminary economic assessment of suggested solutions and engineering work n   Knowledge at blocks, stabili and robotics of aut operating principles of components and systems related to the field of study, including theories, methods and complex relationships between them,	October 2024     Academic year of realisation of subject       first-cycle studies     Subject group       Full-time studies     Mode of delivery       2     Language of instruction       3     ECTS credits       general academic profile     Assessment form       Department of Biomedical Engineering -> Faculty of Electronics, T       Subject supervisor     dr in2. Grzegorz Jasiński       Teachers     dr in2. Grzegorz Jasiński       Lesson type     Lecture     Tutorial       Number of study     30.0     0.0     30.0       Number of study     60     5.0     Consultation h       Number of study     60     5.0     Consultation h       Number of study     60     5.0     Subject outcome       K6_U08] while identifying and formulating specificans of engineering tasks related to the field of study and solving these tasks, can apply analytical, simulation and experimental methods, not obcis, scilding assemblity criteria, feedback and rob     Knowledge and understands the understands, to an advanced extent, selected laws of physics and physical phenomena as well as methods and theories explaining the complex relationships between them, constituting the basic general knowledge in the field of technical sciences related to the field of study, including theories, methods and complex relationshi	October 2024     Academic year of realisation of subject       first-cycle studies     Subject group       Full-time studies     Mode of delivery       2     Language of instruction       3     ECTS credits       general academic profile     Assessment form       Department of Biomedical Engineering -> Faculty of Electronics, Telecom       Subject supervisor     dr in2. Grzegorz Jasiński       Teachers     dr in2. Grzegorz Jasiński       Lesson type     Lecture     Tutorial       Lesning hours included: 0.0     Learning nours included: 0.0     Elearning nours included: 0.0       Learning activity     Participation in didactic classes included in study plan     Sol       Number of study hours     60     5.0       The aim is to acquaint students with the methods of analysis the dynamic basics of inear control systems and static analysis of biomedical control s presented in the time and frequency domain, including the stability analys issues of roboits; and robots, including assemblies and systems of robot is to provide students with the knowledge and ability to analyse processes       Course outcome     Subject outcome       [K6_U08] while identifying and formulating specifications of engineering tasks related to the field of study and solving these tasks, can:n- apply analytical, simulation and engineering work n     K	October 2024   Academic year of realisation of subject   20257.     first-cycle studies   Subject group   Obige field of     Full-time studies   Mode of delivery   at the 2     Language of instruction   Polish     3   ECTS credits   5.0     general academic profile   Assessment form   exam     Department of Biomedical Engineering -> Faculty of Electronics, Telecommunica   Subject supervisor   dr iz. Grzegorz Jasiński     Teachers   dr iz. Grzegorz Jasiński   Elesanting hours included: 0.0   30.0   0.0     Learning nours included: 0.0   Elearning hours included: 0.0   Subject outcome   Self-st     Number of study   60   5.0   60.0   60.0     Number of study   60   5.0   60.0   60.0     Number of study   60   5.0   60.0   60.0     Number of study   60   folder analysis the dynamics, Presises of robots, sand orbots, including assemblies and systems of robots, sand tobits, including assemblies and systems orbots and robots, including assemblies and systems orbots, sand tobits, including assemblies and systems or botos, sand tobits, including the stability analysis. Presisues of robots, and robots, including assemblies and systems or botos, sand worked and robotics components   SU31/4 </td <td>October 2024   Academic year of realisation of subject   2025/2026     first-cycle studies   Subject group   Obligatory subject gried of study     Full-time studies   Mode of delivery   at the university     2   Language of instruction   Polish     3   ECTS credits   5.0     general academic profile   Assessment form   exam     Department of Biomedical Engineering -&gt; Faculty of Electronics, Telecommunications and Infor   Subject supervisor   dr in2. Grzegorz Jasiński     Teachers   dr in2. Grzegorz Jasiński   Eesam     Leson type   Lecture   Tutorial   Laboratory   Project   Seminar     Number of study   30.0   0.0   0.0   0.0   0.0     Learning hours included: 0.0   E-tearning hours included: 0.0   Go.0   0.0     The aim is to acquaint students with the methods of analysis the dynamic systems of automatic systems are presented presented in the time and frequency domain, including the stability analysis. Presented are also including asseembles and systems of robotics, sensors and actude to proviote students with the knowledge and ability to analysis the dynamic</td>	October 2024   Academic year of realisation of subject   2025/2026     first-cycle studies   Subject group   Obligatory subject gried of study     Full-time studies   Mode of delivery   at the university     2   Language of instruction   Polish     3   ECTS credits   5.0     general academic profile   Assessment form   exam     Department of Biomedical Engineering -> Faculty of Electronics, Telecommunications and Infor   Subject supervisor   dr in2. Grzegorz Jasiński     Teachers   dr in2. Grzegorz Jasiński   Eesam     Leson type   Lecture   Tutorial   Laboratory   Project   Seminar     Number of study   30.0   0.0   0.0   0.0   0.0     Learning hours included: 0.0   E-tearning hours included: 0.0   Go.0   0.0     The aim is to acquaint students with the methods of analysis the dynamic systems of automatic systems are presented presented in the time and frequency domain, including the stability analysis. Presented are also including asseembles and systems of robotics, sensors and actude to proviote students with the knowledge and ability to analysis the dynamic	

Subject contents	1 Basic concepts of automation, the basic principles of automatic control, classification of control systems 2 Elements of automatic control systems: measuring devices, controllers, actuators. 3 The concept of control systems for biomedical systems. Examples of physiological regulatory systems. 4 Biomedical Modeling dynamic systems. Linear systems. The principle of superposition. 5 Transfer function operationally. Description of the state into space. 6 Basic linear units of automation systems: proportional, inertial, integrator, differentiator, oscillating delay. 7 Computer analysis and simulation of biomedical systems. Matlab. Simulink. 8 Static analysis of biomedical control systems. 9 Static analysis of biomedical control systems. Examples: regulation of cardiac output, blood glucose regulation, regulation of gas exchange. 10 Analysis of linear control system in the time domain. Systems with open and closed loop. 11 The impulse response. Step response. 12 The impulse response. Step response. Example: description of the dynamics of neuromuscular reflex. 13 Frequency analysis of linear control systems. 14 graphical character frequency response (Bode, Nicholas, Nyquist). 15 Frequency response model of the cardiovascular system and glucose-insulin control. 1916 Stability of linear automatic control systems: the concept and criteria for stability. 17 Analysis of the stability of the pupil reflex to light. Study the stability control system disorder breathing Cheyne-Stokes syndrome (night sleep). 18 Some problems of nonlinear automatic control systems. 19 Elements implementing automation and robotics. 20 sensors in automation and robotics. 21 basic units and systems of industrial robots 22 robots and manipulators. Drives robots. Holding devices 23 24 heads technology 24 Control of robots. 26 Construction and ways of learning educational robots. 27 robots programming education. 28 Examples of the use of robots in industry. 29 submarines and robots working in hazardous conditions. 30 Examples of the use of robots in						
Prerequisites and co-requisites	No requirements						
Assessment methods	Subject passing criteria	Passing threshold	Percentage of the final grade				
and criteria	lecture	50.0%	70.0%				
	laboratory	50.0%	30.0%				
Recommended reading	Basic literature	1. Script materials "Podstawy automatyki i robotyki" 2. Kwiatkowski W.: Wprowadzenie do Automatyki, Warszawa 2005. 3. Craig J.: Wprowadzenie do robotyki. WNT, Warszawa 1995 4. Morecki A. I in.: Podstawy robotyki, WNT, Warszawa 2002 (wyd. II) 5. Olszewski I in.: Podstawy mechatroniki, REA, Warszawa 2006.					
	Supplementary literature	1. Khoo M.C.K.: Physiological Control Systems, IEEE Press 2000 2. Bishop H.R.: Mechatronic Systems control, Logic and Data Aquisition, CRC Press 2008 3. Bishop H.R.: Mechatronic Systems, Sensors and Actuators, CRC Press 2008					
	eResources addresses	Adresy na platformie eNauczanie:					
Example issues/ example questions/ tasks being completed	Stability study of linear automatic control systems Measurements of mechanical vibrations. Units of the second order.						