GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Basics of Automatic Control and Robotics, PG_00068212		
Field of study	Biomedical Engineering		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2026/2027
Education level	first-cycle studies	Subject group	Obligatory subject group 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	3	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Biomedical Engineering -> Faculty of Electronics Telecommunications and Informatics -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Grzegorz Jasiński	
	Teachers	dr inż. Grzegorz Jasiński	

Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	21.0	0.0	0.0	36
	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	36	2.0	62.0	100

Subject objectives	The aim of the course is to introduce students to methods for describing and analyzing dynamic control systems, with particular emphasis on applications in biomedical engineering. The course covers basic components of linear automatic control systems and includes static analysis of biomedical regulatory systems. Topics also include time-domain and frequency-domain analysis, including stability analysis. Additionally, fundamental issues related to robotics and automation are presented, especially in the context of their application in biomedicine.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[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	Has basic knowledge of control systems theory and the operating principles of fundamental automation components.	[SW1] Assessment of factual knowledge
[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	Is able to analyze and interpret the behavior of simple control systems based on their mathematical models. Can perform a basic stability analysis of a control system using appropriate methods (e.g., step response, frequency characteristics). Is capable of identifying and selecting an appropriate type of controller for a given system.	[SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information
[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 theories, methods and complex relationships between them and selected specific issues - appropriate for the curriculum	Knows the methods of analyzing dynamic systems in the time and frequency domains, as well as the basics of stability analysis. Understands the applications of automation and robotics in biomedical engineering, including the role of control systems in biological and medical processes.	[SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects

Subject contents

Course content – lecture
Basic concepts of automation, fundamental principles of automatic control, and classification of automation systems. Components of automatic control systems: measurement devices, controllers, and actuators. The concept of control systems in relation to biomedical systems. Examples of physiological control systems. Operator transfer function. Basic elements of linear automation systems: proportional, inertial, integrating, differentiating, oscillatory, and delay elements. Analysis of linear control systems in the time domain. Open-loop and closed-loop control systems. Impulse response and step response. Frequency analysis of linear control systems. Graphical representation of frequency response (Bode, Nichols, and Nyquist plots). Stability of linear automatic control systems: concept and stability criteria. Stability analysis of the pupillary light reflex. Examination of stability disturbances in the respiratory control system in Cheyne-Stokes syndrome. Introduction to robotics: robot kinematics and control elements. Construction and applications of educational robots and their programming. Examples of industrial robot applications, underwater robots, and robots operating in hazardous environments. Applications of robots in medicine.

Prerequisites and co-requisites

Knowledge of basic mathematics, in particular partial fraction decomposition, differential equations, integrals, and Laplace transforms. Fundamentals of human physiology.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
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. 6. Błażewicz J., Podstawy automatyki, Wydawnictwo Naukowe PWN, Warszawa, 2015.
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 4. Ogata K., Modern Control Engineering, 5th Edition, Prentice Hall, 2010
eResources addresses	

Example issues/ example questions/ tasks being completed

Stability study of linear automatic control systems

Measurements of mechanical vibrations. Units of the second order.

Actuators and sensors in robotics

Practical activites within the subject

Not applicable