GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Fundamentals of Control Engineering II, PG_00053201		
Field of study	Automation, Robotics and Control Systems		
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
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	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Katedra Inteligentnych Systemów Sterowania i Wspomagania Decyzji -> Faculty of Electrical and Control Engineering		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Rafał Łangowski	
	Teachers	dr inż. Rafał Łangowski dr inż. Tomasz Zubowicz dr inż. Bartosz Puchalski	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	0.0	0.0	30.0	0.0	0.0	30
	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	30	1.0	19.0	50

Subject objectives	
	The main module objectives are: a) to acquire knowledge needed for modelling and analysis of dynamic systems of low order, b) to design of control systems for such systems.

Learning outcomes	**Course outcome**	**Subject outcome**	**Method of verification**
	K6_U07	On successful completion of this course, the student will be able to: - Derive the first principle dynamic models of the low complexity systems such as R, L, C electrical circuits, DC electrical motors, heat transfer and fluid flow systems; - Analyse basic properties of single input - single output (SISO) linear time invariant dynamic systems based on zeros and poles nad to analytically calculate their responses to typical input signals; - Investigate stability of SISO systems based on the poles by applying the algebraic Routh-Hurwitz criterion - Investigate stability of feedback systems by applying the frequency domain based Nyquist stability criterion - Assess stability robustness of feedback systems based on the open loop system phase and gain margins.	[SU3] Assessment of ability to use knowledge gained from the subject
	K6_W07	On successful completion of this course, the student will be able to: - Explain structures and properties of P, PI and PID controllers and experimentally determine their parameters by applying Ziegler - Nichols methods to lower order processes; - Explain structures of state-feedback controllers, also in the case of unmeasured state variables to lower order processes; - Design by pole placement the basic controller systems meeting the performance specifications in time domain and state observers.	[SW1] Assessment of factual knowledge
Subject contents	The course is carried out as 10 three-hour laboratory sessions with the following schedule. 1. Basic operations on numbers and matrices in the MATLAB environment. 2. MATLAB - instructions, external functions and graphics. Introduction to the Control System Toolbox. 3. Introduction to the SIMULINK package in the MATLAB environment. 4. Time domain analysis for elementary automation plants. 5. Frequency analysis for elementary automation plants. 6. Static and dynamic properties of control systems - part I. 7. Static and dynamic properties of control systems - part II. 8. PID control systems - part I. 9. PID control systems - part II. 10. PID control of the DC motor.		
Prerequisites and co-requisites	Fundamentals of linear time invariant and scalar differential equations, Laplace transforms, complex numbers and matrix algebra. Moreover, the basic knowledge of signal processing and sensors and actuators. The Pre-Requisites: Information Technology, Metrology, Computer Networks and Internet Technology, Electronics (term 2), Basic of Digital Technology, Fundamentals of Control Engineering I (semester 3), Matrix Algebra, Automation Equipment.		
Assessment methods and criteria	**Subject passing criteria**	**Passing threshold**	**Percentage of the final grade**
	laboratory classes	50.0%	100.0%

Recommended reading	Basic literature	1. Dorf C.D., Bishop R. H.: Modern control systems. Eleventh Edition. Pearson Prentice Hall, Upper Saddle River, NI 07458, 2008. 2. Kaczorek T. Teoria układów regulacji automatycznej, Wydawnictwa Naukowo-Techniczne, Warszawa, 1974. 3. Kabziński J. Teoria sterowania Projektowanie układów regulacji, Wydawnictwo Naukowe PWN, Warszawa, 2021. 4. Ogata K.: Modern Control Engineering. Fifth Edition, Pearson Prentice Hall, Upper Saddle River, NI 07458, 2010. 5. Nise N.S. Control System Engineering. 3th edition. John Wiley & Sons, 2000. 6. Ljung L., Glad T.: Modelling of Dynamic Systems, Prentice Hall, 1994.
	Supplementary literature	1. Ogata K. Designing Linear Control Systems with MATLAB. Prentice Hall, 2002. 2. Franklin G.E., Powell J.D., Emami-Naeini E. Feedback Control of Dynamic Systems. Addison Wesley Publishing Company, 1994. 3. Dutton K., Thompson S., Barraclough B. The Art of Control Engineering. Pearson, Prentice Hall, 1997.
	eResources addresses	
Example issues/ example questions/ tasks being completed	1) Analysis of plants properties;2) Linearity and nonlinearty;3) Hurwitz, Routh and Nyquist stabiluity criteria; 4) PID controller design;	
Work placement	Not applicable	