GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Basics of Discrete Systems, PG_00047618		
Field of study	Automatic Control, Cybernetics and Robotics		
Date of commencement of studies	October 2021	Academic year of realisation of subject	2023/2024
Education level	first-cycle studies	Subject group	Optional subject group 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	3	Language of instruction	Polish
Semester of study	6	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Decision Systems and Robotics -> Faculty of Electronics, Telecommunications and Informatics		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Mariusz Domżalski	
	Teachers	dr inż. Mariusz Domżalski	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	15.0	0.0	0.0	0.0	45
	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	45	4.0	51.0	100

Subject objectives	Mastering knowledge and acquiring skills in the field of process control in discrete-time.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_U01] can apply mathematical knowledge to formulate and solve complex and non-typical problems related to the field of study and perform tasks, in an innovative way, in not entirely predictable conditions, by:n- appropriate selection of sources and information obtained from them, assessment, critical analysis and synthesis of this information,n- selection and application of appropriate methods and toolsn	Student is able to analyze control systems with discrete time. Student is able to solve the problems of controlling discrete-time objects.	[SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject
	[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	Student has the knowledge of the basic problems of industrial computer control systems.	[SW1] Assessment of factual knowledge
	[K6_W01] Knows and understands, to an advanced extent, mathematics necessary to formulate and solve simple issues related to the field of study	Student knows the stability testing methods and synthesis of control systems (linear and nonlinear).	[SW1] Assessment of factual knowledge
	[K6_W04] Knows and understands, to an advanced extent, the principles, methods and techniques of programming and the principles of computer software development or programming devices or controllers using microprocessors or programmable elements or systems specific to the field of study, and organisation of systems using computers or such devices	Student knows the description of control systems and their contemporary ideas.	[SW1] Assessment of factual knowledge

Subject contents	1) Basics of processing and discrete control: - General characteristics of discrete signals and systems; - Methods for the analysis of discrete systems; - Description methods of discrete and digital systems; 2) Discrete systems: - Basic properties of discrete systems; - Description of discrete systems using difference equations; - Other ways of describing the discrete systems. 3) Z transformation: - Introduction: deterministic signals; - bilateral transformation; - One-sided transformation; - Multidimensional Transformation; - Modified Z transformation; - The inverse Z transform; - Applications: transfer function based on differential equations, state equations, and graphs. 4) Stability of discrete systems: - Necessary conditions and criteria for stability; - Method of the 'w' plane; - Frequency methods; - Nyquist criterion; - Marden-Yury criteria. 5) Spectral analysis of signals: - Simple and inverse transformations; - Sampling theorem;

	- Discrete Fourier Transform. 6) The theory of discrete linear systems: - Reachability and controllability; - Reproducibility and observability; - The theory of discrete linear systems; - Stabilizability and the complete description of systems; - Identity transformations. - The canonical structure of discrete linear systems; - Diagonal form, Vandermonde matrix; - Determining the transformation matrix; - Canonical structure of discrete linear systems; - Determining the transformation matrix; Normal forms and their transformation matrices for the regulator, observer, controllable, and observable forms.
Prerequisites and co-requisites	

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
exam	50.0%	60.0%
exercise	50.0%	40.0%

Recommended reading

Basic literature	A.V. Oppenheim, R.W. Schafer: "Discrete-time Signal Processing" Prentice Hall 1975
Supplementary literature	Norman S. Nise, "Control Systems Engineering", Willey, 2010 Monson Hayes, "Schaums Outline of Digital Signal Processing", McGraw-Hill, 2011
eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed

1) Determine the step response for a system described by a given transmittance G (z).
2) Draw the graph and determine the transmittance of a system described by a state model A, B, C, D.
3) Determine the frequency characteristics of a system described by a given transmitance G (z).
4) Examine the stability of the system.
5) Examine whether the system is controllable / observable.

Work placement

Not applicable