



Subject card

Subject name and code	Digital Control, PG_00048421						
Field of study	Automatic Control, Cybernetics and Robotics						
Date of commencement of studies	February 2022	Academic year of realisation of subject			2022/2023		
Education level	second-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	1	Language of instruction			Polish		
Semester of study	2	ECTS credits			2.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Department of Decision Systems and Robotics -> Faculty of Electronics, Telecommunications and Informatics						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Janusz Kozłowski				
	Teachers		dr inż. Janusz Kozłowski				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	0.0	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		2.0		18.0	50
Subject objectives	The aim of the course is to master the knowledge of methods for modeling of dynamic processes as objects subject to automatic control, as well as mathematical transformations and the methods of control system design.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K7_W21] Knows and understands, to an advanced extent, methods and techniques of design and operation of automatic control systems, control and robotics systems, as well as the use of computers in the control and monitoring of dynamic objects		The student understands the methods and techniques of design and operation of automatic control systems and control and robotics, as well as the use of computers in the control and monitoring of dynamic objects		[SW1] Assessment of factual knowledge		
	[K7_U21] can individually carry out an in-depth analysis of controlling, diagnostics and signal processing problems; and, to an advanced extent, is able to individually design, tune and operate automatic regulation, control and robotics systems; and use computers to control and monitor dynamic systems		Student gets acquainted with the basic problems of modelling computer-controlled systems and designing systems of direct digital control.		[SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools [SW1] Assessment of factual knowledge		
	[K7_U03] can design, according to required specifications, and make a complex device, facility, system or carry out a process, specific to the field of study, using suitable methods, techniques, tools and materials, following engineering standards and norms, applying technologies specific to the field of study and experience gained in the professional engineering environment		Student is able to design and make a device or system, using methods, techniques and tools and materials, using standards and norms, using appropriate technologies		[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		

Subject contents	1. Analysis and synthesis of digital control systems: making system discrete and analog (discretization and analogization); continuous and discrete modeling. 2. Discretization and discrete-time modeling of continuous-time systems; Analogization and continuous-time modeling of discrete-time systems. 3. System approaches: discretization i analogization. 4. Discrete-time approximation as a model approach. 5. Analog to digital processing (ADC conversion). 6. Rules of conversion (sampling, quantization, coding). 7. Deterministic approaches to setting ADC parameters. 8. Probabilistic approaches to setting ADC parameters. 9. Digital to analog processing (DAC conversion): Rules of conversion (decoding and signal generation). 10. Positional and incremental DAC decoding. 11. Generating continuous-time signals: rules, and current methods (extrapolators). 12. Generating continuous-time signals: block methods (interpolators). 13. Analysis of digital control systems for continuous-time processes. 14. Analysis: equivalent models. 15. Analysis: transfer function models. 16. Analysis: state-space models. 17. Digital system synthesis via discrete approximation method. 18. Discrete approximation methods. 19. Time response invariance methods. 20. Frequency characteristic invariance. Relations between the s- and z-planes. 21. Synthesis of discrete-time controllers: Basic tasks of regulation and methods of control system design. 22. Synthesis: Compensation methodology: Realizability. 23. Synthesis: Compensation methodology: Stability of non-observable and non-controllable modes. 24. Synthesis: Compensation methodology: astatism, and finite (minimal) settling time. 25. Synthesis of discrete-time controllers: Parameter optimization approaches. 26. State-space controllers: Pole placement. Regulator-form approach. 27. State-space controllers: Modal control. 28. State-space controllers: Finite settling-time controllers. 29. State-observer based control: dual design. 30. State observers.		
Prerequisites and co-requisites	Completing the subjects of the previous semester		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Written exam	50.0%	100.0%
Recommended reading	Basic literature	W.L. Brogan: Modern control theory, Prentice Hall, Englewood Cliffs, 1974. K.J. Astrom, B Wittenmark: Computer-controlled systems. Prentice Hall, Upper Saddle River, 1997	
	Supplementary literature	No requirements	
	eResources addresses		
Example issues/ example questions/ tasks being completed			
Work placement	Not applicable		