



Subject card

Subject name and code	Digital Control, PG_00048421						
Field of study	Automatic Control, Cybernetics and Robotics						
Date of commencement of studies	February 2027	Academic year of realisation of subject			2027/2028		
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 -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Janusz Kozłowski				
	Teachers		dr inż. Janusz Kozłowski				
Lesson types	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_W02] knows and understands, to an increased extent, selected laws of physics and physical phenomena, as well as methods and theories explaining the complex relationships between them, constituting advanced general knowledge in the field of technical sciences related to the field of study	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_U02] can perform tasks related to the field of study as well as formulate and solve problems applying recent knowledge of physics and other areas of science	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		
	[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			[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information		

Subject contents	<p>Course content – lecture</p> <p>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.</p>								
Prerequisites and co-requisites	Completing the subjects of the previous semester								
Assessment methods and criteria	<table border="1" data-bbox="448 624 1498 696"> <thead> <tr> <th data-bbox="448 624 798 658">Subject passing criteria</th> <th data-bbox="802 624 1139 658">Passing threshold</th> <th data-bbox="1144 624 1498 658">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="448 665 798 696">Written exam</td> <td data-bbox="802 665 1139 696">50.0%</td> <td data-bbox="1144 665 1498 696">100.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Written exam	50.0%	100.0%
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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	<ol style="list-style-type: none"> 1. Describe practical methods for selection of the sampling time of analogue signals. 2. Characterise different methods of the digital-to-analogue conversion. 3. Introduce digital implementations of the PID controller. 4. Describe advantages of the state feedback. 5. Explain, how the state observer can be utilised in implementation of the state feedback. 								
Practical activites within the subject	Not applicable								

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