

## SDAŃSK UNIVERSITY 的 OF TECHNOLOGY

## Subject card

Automation and robot	tics, PG_00050	)291					
Mechanical Engineeri	ing, Mechanica	I Engineering					
		Academic year of realisation of subject		2022/2023			
first-cycle studies		Subject group		Obligatory subject group in the field of study Subject group related to scientific research in the field of study			
Full-time studies		Mode of delivery		at the university			
		•		Polish			
					5.0		
				exam			
					ineering and Ship Technology		
Teachers							
		dr inż. Michał Mazur					
Lesson type	Lecture	Tutorial	Laboratory	Projec	t	Seminar	SUM
Number of study hours	30.0	15.0	15.0	0.0		0.0	60
-	ided: 0.0		i				
Learning activity				Self-study S		SUM	
Number of study hours	60		6.0		59.0		125
Presentation of the fundamental issues related to automatic control systems, robots and manipulators. Knowing the structure and components of a typical control system. Gaining general information about the methods of designing, analysis and study of the properties of typical control systems. Acquisition of knowledge about the construction of typical, industrial robots and manipulators. Learning of methods for modeling, analysis and control of robots.							
Course outcome Subject outcome Method of verification			rification				
knowledge on autom	6_W06] possesses elementary nowledge on automatics and The student knows the structure of a typical automation system and knowledge		of factual				
[K6_U03] is able to identify, formulate and develop the documentation of a simple design or technological task, including the description of the results of this task in Polish or in a foreign language and to present the results using computer software or other aiding toolsHe is able to build, design and analyze basic automatic control systems with the typical, universal industrial controllers.		[SU4] Assessment of ability to use methods and tools					
Definition of basic terms. General structure of control system. Classification and examples of control system elements. Analog and digital control systems. Basic information about digital control systems. Boolean algebra. Combinational logic system. Sequential logic system. Design, synthesis and analysis of digital control systems. Basic information about analog control systems. A typical connections of components. Block diagrams and their transformations. Feedback. Description and classification of signals. Standard signals. Method of description control systems, elements and signals. Application of the Laplace transformation. Concept of transfer function. Static and dynamic characteristics of control systems. Time responses. Frequency characteristics. Nyquist and Bode plots. Controllers. Tuning of PID controller. Classification of robots and manipulators. Construction, modeling and analysis of robot motion. Introduction to robot control systems. The sensors used in industrial robots. Fundamentals of programming robots. Application of robots. Laboratory: Design of combinational and sequential logic circuits. Time and frequency characteristics of selected control system components. Modeling and simulation of control systems and robots.							
	Mechanical Engineeri October 2020 first-cycle studies Full-time studies 3 5 general academic pro- Institute of Mechanics Subject supervisor Teachers Lesson type Number of study hours E-learning hours inclu Learning activity Number of study hours E-learning hours inclu Learning activity Number of study hours Presentation of the fu Knowing the structure methods of designing knowledge about the modeling, analysis ar Course out [K6_W06] possesses knowledge on autom robotics of mechanic formulate and develo documentation of a s or technological task description of the res task in Polish or in a language and to pres results using comput other aiding tools Definition of basic tern elements. Analog and algebra. Combination control systems. Basi Block diagrams and tt signals. Method of de transformation. Concor classification of robots. characteristics of sele	Mechanical Engineering, Mechanical         October 2020         first-cycle studies         isst-cycle studies         3         5         general academic profile         Institute of Mechanics and Machine         Subject supervisor         Teachers         Lesson type       Lecture         Number of study hours       30.0         E-learning hours included: 0.0       Learning activity         Participation in classes included plan         Number of study hours       60         Presentation of the fundamental issue Knowing the structure and compone methods of designing, analysis and knowledge about the construction of modeling, analysis and control of rol         Course outcome       [K6_W06] possesses elementary knowledge on automatics and robotics of mechanical systems         [K6_W06] possesses elementary knowledge and to present the results using computer software or other aiding tools         Definition of basic terms. General st elements. Analog and digital control algebra. Combinational logic system control systems. Basic information a Block diagrams and their transforma signals. Method of description control algebra. Combinational logic system control systems. The senso Application of robots. Laboratory: De characteristics of selected control sy	Mechanical Engineering, Mechanical Engineering         October 2020       Academic y         realisation         first-cycle studies       Subject grown         Full-time studies       Mode of de         3       Language         5       ECTS cred         general academic profile       Assessment         Institute of Mechanics and Machine Design -> Fact         Subject supervisor       dr inż. Michał         Teachers       mgr inż. Grze         dr inż. Michał       Teachers         Number of study       30.0       15.0         Number of study       30.0       15.0         Presentation of the fundamental issues related to a       Knowing the structure and components of a typical         Number of study       60       00         Presentation of the fundamental issues related to a       Knowing the structure and components of a typical         K6_W06] possesse elementary       The student k       a typical auto         robotics of mechanical systems       The student k       a typical auto         robotics of mechanical systems       Sequential io       automatic con         Learning activity       K6_U003] is able to identify,       He is able to identify,       analyze basic         formulate and develop the	Mechanical Engineering, Mechanical Engineering           October 2020         Academic year of realisation of subject           first-cycle studies         Subject group           Full-time studies         Mode of delivery           3         Language of instructio           5         ECTS credits           general academic profile         Assessment form           Institute of Mechanics and Machine Design -> Faculty of Mechan           Subject supervisor         dr in2. Michał Mazur           Teachers         mgr in2. Grzegorz Banaszei dr in2. Michał Mazur           Lesson type         Lecture         Tutorial           Laboratory         Number of study         30.0         15.0           Number of study         30.0         15.0         consultation f           Presentation of the fundamental issues related to automatic contr         Knowing the structure and components of a typical control system           Number of study         60         6.0           Presentation of the fundamental issues related to automatic contr         Knowiedge about the construction of typical, industrial robots and modeling, analysis and study of the properties of typi knowiedge about the construction of typical, industrial robots.           Course outcome         Subject outcome           [K6_W06] possessee elementary         The student knows the structory systems. <td>Mechanical Engineering           October 2020         Academic year of realisation of subject           first-cycle studies         Subject group           Full-time studies         Mode of delivery           3         Language of instruction           5         ECTS credits           general academic profile         Assessment form           Institute of Mechanics and Machine Design -&gt; Faculty of Mechanical Eng           Subject supervisor         dr in2. Michał Mazur           Teachers         mgr in2. Grzegorz Banaszek           dr in2. Michał Mazur         Eesson type           Lesson type         Lecture         Tutorial           Number of study         30.0         15.0         15.0           Number of study         60         6.0           Presentation of the fundamental issues related to automatic control system. Gainin tendos and manipu modeling, analysis and study of the properties of typical control system. Gainin tendos and manipu modeling, analysis and study of the properties of typical control systems and robotics of mechanical systems           IK6_WOGI possesses elementary knowledge on automatics and robotics.         The student knows the structure of analyze basic automatic control systems with the typical, universal industrial control systems. He is able to build, design and analyze basic automatic control systems. He is able to build, design and analyze basic automatic control systems. Along and digital control systems. Sequential logi</td> <td>Mechanical Engineering, Mechanical Engineering         2022/           October 2020         Academic year of realisation of subject         2022/           first-cycle studies         Subject group         Oblig; field of Subject         Subject group         Oblig; field of Subject           first-cycle studies         Mode of delivery         at the Subject group         Oblig; field of Subject group         Oblig; field of Subject Subject and the Subject supervisor           5         ECTS credits         5.0           general academic profile         Assessment form         exam           Institute of Mechanics and Machine Design -&gt; Faculty of Mechanical Engineering         Subject supervisor         dr inz. Michał Mazur           Teachers         mgr in2. Grzegorz Banaszek dr in 2. 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Michał Mazur           Teachers         mgr in2. Grzegorz Banaszek         dr in2. Michał Mazur           Lesson type         Lecture         Tutorial         Laboratory         Project         Seminar           Number of study         30.0         15.0         15.0         0.0         0.0           Number of study         Participation in didactic classes included in study plan         Self-study classes included in study plan           Number of study         60         6.0         59.0         Self-study classes and manipulators. Learning of m modeling, analysis and study is top optical sothardito na</td>	Mechanical Engineering           October 2020         Academic year of realisation of subject           first-cycle studies         Subject group           Full-time studies         Mode of delivery           3         Language of instruction           5         ECTS credits           general academic profile         Assessment form           Institute of Mechanics and Machine Design -> Faculty of Mechanical Eng           Subject supervisor         dr in2. Michał Mazur           Teachers         mgr in2. Grzegorz Banaszek           dr in2. Michał Mazur         Eesson type           Lesson type         Lecture         Tutorial           Number of study         30.0         15.0         15.0           Number of study         60         6.0           Presentation of the fundamental issues related to automatic control system. 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Prerequisites	Mathematics, Physics, Mechanics	3			
and co-requisites					
Assessment methods	Subject passing criteria	Passing threshold	Percentage of the final grade		
and criteria	Laboratory (reports from laboratory exercises)	56.0%	30.0%		
	Written exam	56.0%	40.0%		
	Midterm colloquium	56.0%	30.0%		
Recommended reading	Basic literature Supplementary literature	<ul> <li>Wydawnicza Politechniki Warszi</li> <li>2. Żelazny M.: Podstawy autom Naukowe, 1976,</li> <li>3. Perycz S.: Podstawy automat</li> <li>4. Węgrzyn S.: Podstawy autom</li> <li>5. Jarzębowska E.: Podstawy dy Oficyna Wydawnicza PW. Warsz</li> <li>6. Morecki A., Knapczyk J., Kęd manipulatorów. WNT. Warszawa</li> </ul>	atyki, Państwowe Wydawnictwo yki. Skrypt PG, Gdańsk 1983, atyki. PWN Warszawa, 1978, mamiki mechanizmów i manipulatorów. zawa 2002, zior K.:Teoria mechanizmów i a 2002, robotyki. Mechanika i sterowanie.		
		2. Morecki A., Knapczyk J.: Podstawy robotyki. Teoria i elementy manipulatorów i robotów. WNT. Warszawa 1993.			
	eResources addresses	Adresy na platformie eNauczanie:			

	Automation	
Example issues/ example questions/ tasks being completed	Automation	
	1. Describe the ACS scheme - Give an example	
	2. Spectral transmittance	
	3. What is the static characteristic of the term?	
	4. Approximation of the nonlinear static characteristic of the term in the vicinity of the operating point	
	5. The proportional term	
	6. 1st order inertial term	
	7. The integral term	
	8. The oscillating term	
	9. The ideal derivative term	
	10. Real derivative term	
	11. The delay term	
	12. Phase shift term	
	13. Stability of automation systems	
	14. Hurwitz criterion	
	15. Nyquist criterion	
	16. Static error	
	17. PID controller	
	18. Two-position regulation	
	19. Controllability	
	20. Observability	
	21. Optimum control with total quality criterion	
	Robotics	
	1. What is an industrial robot?	
	2. What is a mobile robot?	

3. What is a manipulator?
4. What does robotics do?
5. Applications of industrial robots.
6. Introduce and describe the basic kinematic structures of stationary industrial robots.
7. What is the difference between a robot with a kinematic structure in the Cartesian system and a robot with a kinematic structure in an anthropomorphic system?
8. List and discuss the basic units and systems of an industrial robot.
9. Advantages and disadvantages of robots with a parallel structure.
10. List the applications of mobile robots.
11. What is a workspace?
12. What is a manipulation space?
13. What is the task of simple kinematics?
14. What is the inverse of kinematics?
15. Tasks of the control system.
16. Describe methods of programming industrial robots.
17. What are servo drives?
18. What is positioning accuracy?
19. What is repeatability?
20. Applications and types of interpolation in robotics.
21. List the advantages and disadvantages of the hydraulic drive for industrial robots.
22. List the advantages and disadvantages of a pneumatic drive for industrial robots.
23. List the advantages and disadvantages of an electric drive for industrial robots.
24. Requirements for gears used in industrial robots.
25. Discuss the applications and operation of helical gears.
26. Discuss the application and operation of harmonic gear.
27. Discuss the operation of revolvers.

	28. Discuss the operation of encoders.
	29. Describe the operation of ultrasonic proximity sensors.
	30. Applications of touch sensory systems.
Work placement	Not applicable