



Subject card

Subject name and code	Robotics, PG_00057380						
Field of study	Mechanical Engineering, Space and Satellite Technologies						
Date of commencement of studies	February 2024	Academic year of realisation of subject			2023/2024		
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			English		
Semester of study	1	ECTS credits			2.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Institute of Mechanics and Machine Design -> Faculty of Mechanical Engineering and Ship Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Michał Mazur					
	Teachers	dr inż. Michał Mazur dr inż. Wiktor Sieklicki					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	15.0	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	4.0		16.0	50	
Subject objectives	Expanding knowledge about robots and manipulators. Some specific issues relating to the actors, sensors and control systems.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K7_W06] possesses organized, profound knowledge necessary for designing and optimization of complex technological processes, modelling and calculations using numerical methods, knows modern manufacturing methods and tools for designing manufacturing processes of machines, devices, their elements and components	Students have theoretically founded knowledge related to the field of robots.			[SW3] Assessment of knowledge contained in written work and projects		
	[K7_U05] is able to plan and conduct the experimental research determining the parameters of a device or system, assesses the usability and correctly selects methods and tools, is able to interpret the results and estimate the measurement errors and is able to apply computer systems to simulate the operation of a machine or technology	Students know how robots work.			[SW3] Assessment of knowledge contained in written work and projects		
		Students analyze the knowledge contained in scientific publications in order to solve the problems posed to them.			[SU2] Assessment of ability to analyse information		

Subject contents	<p>LECTURE: 1 Introduction 2 Modern trends in the development of two industrial robots 3 Sensors 4 Signal Conditioning 5 Tactile and haptic sensors 6 Methods of localization of mobile robots 7 Effectors 8 Elements of power supply systems 9 Drive chain elements used in robots 10 Tools for robot programming and simulation</p> <p>Laboratory: 1 Programming delta type robot task for ABB IRB360 robot 2 Programming collaborative robot tasks for HCR3a robot using OnRobot vision system 3 Programming of industrial robot movements with force sensor feedback for Nachi NC04 robot 4. developing control algorithms for modular systems using LEGO Mindstorms sets 5. kinematics and dynamics of manipulator movements using the RobotAnalyzer program 6. Development of the manipulator's movement path for the purpose of implementing a specific movement task in a simulation using the Nachi MZ04 manipulator available in the RoboDK 7 program libraries. Operating the Nachi NC04 robot and programming its movement trajectory using a robot controller 8. Operating the IRB360 robot and preparing the manipulator's movement path for the purpose of implementing a specific robot movement task using the RobotStudio program and a robot controller.</p>											
Prerequisites and co-requisites	Basics of mathematics, mechanics and automation, the ability to program engineering calculations.											
Assessment methods and criteria	<table border="1" data-bbox="448 562 1495 667"> <thead> <tr> <th data-bbox="448 562 798 595">Subject passing criteria</th> <th data-bbox="802 562 1141 595">Passing threshold</th> <th data-bbox="1145 562 1495 595">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="448 602 798 629">Laboratory report</td> <td data-bbox="802 602 1141 629">50.0%</td> <td data-bbox="1145 602 1495 629">40.0%</td> </tr> <tr> <td data-bbox="448 636 798 667">Midterm colloquium</td> <td data-bbox="802 636 1141 667">50.0%</td> <td data-bbox="1145 636 1495 667">60.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Laboratory report	50.0%	40.0%	Midterm colloquium	50.0%	60.0%
Subject passing criteria	Passing threshold	Percentage of the final grade										
Laboratory report	50.0%	40.0%										
Midterm colloquium	50.0%	60.0%										
Recommended reading	Basic literature	<ul style="list-style-type: none"> • Craig J., J., Introduction to Robotics: Mechanics and Control • Vidyasagar M., Spong Mark W.: Robot Modeling and Control • Siciliano B., Khatib O.: Springer Handbook of Robotics. Berlin: Springer 2008 • R.C. Dorf, R.H.Bishop, Modern Control Systems, Prentice Hall, 2008 • N.S. Nise, Control Systems Engineering, Wiley, 2015 • G.F. Franklin, J.D. Powell, A. Emami-Naeini, Feedback Control of Dynamic Systems, Addison-Wesley, 1994 • K. Astrom, R. Murray [AM]. Feedback Systems. An Introduction for Scientists and Engineers, Princeton University Press, 2012 • K. Ogata [O]. Modern Control Engineering, Pearson, 5th Edition, 2010 										
	Supplementary literature	<ul style="list-style-type: none"> • Borenstein J., Everett H. R., Feng L.: Where am I? Sensors and Methods for Mobile Robot Positioning. Publikacja elektroniczna. University of Michigan 1996. http://www-personal.umich.edu/~johannb/Papers/pos96rep.pdf 										
	eResources addresses	<p>Adresy na platformie eNauczanie:</p> <p>Robotics, WL, IDE, sem.01, letni 2023/24 (PG_00057380) - Moodle ID: 38061</p> <p>https://enauzanie.pg.edu.pl/moodle/course/view.php?id=38061</p>										
Example issues/ example questions/ tasks being completed	<p>What is a sensor? Advantages and disadvantages of digital sensors? Advantages and disadvantages of analog sensors? Discuss conditioning. Haptic systems.Robots development trends. Advantages and disadvantages of ultrasonic sensors for distance measurement. List the location methods. Techniques for measuring distance. Advantages and disadvantages of monolithic architecture. Advantages and disadvantages of distributed architecture. Robust programming - fault detection techniques. Application of real-time systems in robot control. What is SLAM? What do we use quaternions for? Discuss Spherical Linear Interpolation Applications of dual quaternions. What is ROS? Discuss MoveIT Discuss 2D Navigation in a ROS environment Discuss the control of the quadropeter What is Zero Moment Point?</p>											
Work placement	Not applicable											