COURSE DESCRIPTION CARD

BIALYSTOK UNIVERSITY OF TECHNOLOGY		**Faculty of Electrical Engineering**	
Field of study	Erasmus+ program	**Level and form of study**	Bachelor Level; Master Level
A group of modules /specialty		**Education profile**	general
Course name	Automation and Robotization Systems	**Course code**	IS-FEE-10087S
		Course type	*elective*
Course form(s) and number of hours	**L C LC P SW FW S** 15 15	**Semester**	**Summer**
		ECTS credits	**3**
The programme is valid from	2024/2025		
Introductory courses			

Course objectives

Introduction to concepts in the field of contemporary automation and robotization. Analysis of components in selected automation or robotization systems for industrial and service processes, as well as building automation systems. Learning procedures for designing automation and robotization systems, and creating documentation for newly built systems ordered from integrators. Introduction to the application of robots, and the construction and operation of robotic systems. Utilization of digital computer tools for programming and simulating automated and robotic systems.

Framework programme content

Lecture: Fundamental concepts: production, production processes, automated processes, automatic processes, automation, automation system, control engineering, and automation. Advantages and disadvantages of implementing automation. Automated smart homes, factories, and cities. Comprehensive automation. Automation tools. Service and industrial robotization. Designing a robotic system. Non-technical aspects of robotization: economic-organizational, social, and ethical considerations. Techniques for planning robotization. Industry 4.0. Robotic system, its components, and configurations. Transportation in the immediate vicinity of the robot. Characteristics of automated delivery/retrieval systems to/from the robot. Control of an automated and robotic system. Commissioning and startup of a new robotic system. Safety of automated and robotic systems. Practical applications of robots: close-range transport, assembly, painting, welding, material cutting, dosing, testing and inspection, agriculture and forestry, services, medicine, and rehabilitation. **Specialized workshop:** Developing the concept of an automated (robotic) system based on the analysis of existing solutions. Defining requirements for key functions and relevant performance data. Introduction to working with the Factory I/O virtual factory environment - for modeling, programming, and simulating automated and robotic systems. Introduction to programming programmable logic controllers (PLC) and emulation of system operation using the Siemens PLCSIM Advance simulator and the Siemens TIA Portal programming environment. Configuring components of a technological line built in the digital twin Factory I/O for a selected process, following the adopted concept. Building a control program for a PLC controller managing the components of a production line. Testing the program and verifying the correct operation of the digitally modeled production line in Factory I/O. Developing technical documentation for the assumed scenario of automation and robotization processes in the form of a technical specification for the integrator, supplemented with developed computer programs.

Other information about the course

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the course is related to the scientific activity conducted at the University

Calculation:

Student workload related to:	**Total number of hours**	**including contact**	**including practical**
participation in lectures	15	15	
participation in other forms of activities	15	15	15
participation in an examination	0	0	
participation in consultations	3	3	2
completion of professional training	0	0	0
preparation for passing a lecture/an examination	12		
preparation for practical classes	30		30
Total number of hours:	**75**	**33**	**47**
Total number of ECTS credits:	**3**	**1,3**	**1,9**

Expected discipline learning outcomes

Knowledge	Skills	Social competence

Objectives and framework content prepared by	Ph.D., Eng. Roman Trochimczuk	Date:

Implementation in the academic year **2024/2025**

Programme content

	Lecture
1 2	Basic concepts: production, production processes, automated processes, automatic processes, automation, automation system, control engineering, and automation. Advantages and disadvantages of implementing
3 4	Comprehensive automation. Automation tools. Service and industrial robotization. Designing a robotic system. Non-technical aspects of robotization: economic-organizational, social, and ethical considerations. Techniques for planning robotization. Industry 4.0.
5 6	Robotic system, its components, and configurations.
7 8	Transportation in the immediate vicinity of the robot. Characteristics of automated delivery/retrieval systems to/from the robot.
9 10	Control of an automated and robotic system.
11 12	Commissioning and startup of a new robotic system. Safety of automated and robotic systems.
13 14	Practical applications of robots: close-range transport, assembly, painting, welding, material cutting, dosing, testing and inspection, agriculture and forestry, services, medicine, and rehabilitation.
15	Concluding sessions. Passing the lectures.
	Specialist workshop
1 2	Introductory classes. Developing the concept of an automated (robotic) system based on the analysis of existing solutions. Defining requirements for key functions and relevant performance data.
3 4	Introduction to working with the Factory I/O virtual factory environment - for modeling, programming, and simulating automated and robotic systems.

	5	Introduction to programming programmable logic controllers (PLC) and emulation of system operation using the Siemens PLCSIM Advance simulator and the Siemens TIA Portal programming environment.
	6	
	7	Configuring components of a technological line built in the digital twin Factory I/O for a selected process, following the adopted concept.
	8	
	9	Building a control program for a PLC controller managing the components of a production line.
	10	
	11	Testing the program and verifying the correct operation of the digitally modeled production line in Factory I/O.
	12	
	13	Developing technical documentation for the assumed scenario of automation and robotization processes in the form of a technical specification for the integrator, supplemented with developed computer programs.
	14	
	15	Concluding sessions. Passing laboratory classes.
Teaching methods (on-site classes)	L	Lecture on issues; informational lecture; lecture with multimedia presentation; use of a computer with software.
	SW	Practical sessions at computers with engineering software; implementation of the assumed scenario in a specialized workshop.
Teaching methods (online classes)	-	
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Forms of crediting	L	Written assessment with open-ended questions.
	SW	Preparation of a report.
Conditions of crediting	L	Assessment of responses to open-ended questions in a written exam verifying learning outcomes.
	SW	Evaluation of reports, assessment of ongoing progress in work, discussions, and participation in classes.

Outcome symbols	**Expected learning outcomes**	**Expected learning outcomes defined for the field of study**		
		Knowlegde	Skills	Social competence
	Knowledge: the student knows and understands			
E1	Correctly defines concepts related to automation and robotization.			
E2	Provides stages and describes the essence of designing systems for the robotization and automation of service, production, industrial processes, as well as building automation.			
E3	Lists and analyzes exemplary systems for the robotization or automation of service, production, industrial processes, as well as building automation; analyzes existing technical solutions			
	Skills: the student can			
E4	Designs selected systems for robotization and automation using chosen computer-aided engineering design environments.			
E5	Is able to integrate computer tools to create a digital twin of a selected automated or robotic process in Factory I/O.			
	Social competence: the student is ready to			
E6	Identifies non-technical aspects of robotic and automation systems.			

Outcome symbols	**Methods of verification of learning outcomes**	**Course form subject to verification**
E1	*written assessment*	L
E2	*written assessment*	L
E3	*written assessment*	L
E4	*preparation of reports for the specialized workshop*	SW
E5	*preparation of reports for the specialized workshop*	SW
E6	*preparation of reports for the specialized workshop*	L, SW

Basic references	1	*Zdanowicz R., Robotyzacja dyskretnych procesów produkcyjnych. Wydawnictwo Politechniki Śląskiej, Gliwice, 2011.*
	2	*Marciniak M., Elementy automatyzacji we współczesnych procesach wytwarzania. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa, 2007.*
	3	*Mikulczyński T., Samsonowicz Z.,Więcławek R., Automatyzacja procesów produkcyjnych. Wydawnictwo Naukowe PWN, Warszawa, 2017.*
	4	*Kost G., Łebkowski P., Węsierski Ł., Automatyzacja i robotyzacja procesów produkcyjnych. PWE Polskie Wydawnictwo Ekonomiczne. Warszawa, 2013.*
	5	*Kaczmarek W., Panasiuk J., Robotyzacja procesów produkcyjnych. PWN, Warszawa, 2017.*
Supplementary references	1	*Swider J. red., Sterowanie i automatyzacja procesów technologicznych układów mechatronicznych Układy pneumatyczne i elektropneumatyczne ze sterowaniem logicznym (PLC). Wydawnictwo Politechniki Śląskiej, Gliwice, 2015.*
	2	*Matyszewska E. red. Automatyzacja przemysłu spożywczego Case book. Wydawnictwo Naukowe PWN, Warszawa, 2016.*
	3	*Online databases of scientific journals and scientific publications from the library of Bialystok University of Technology.*
	4	*Web service: iAutomatyka.pl, eplan.pl, astor.com.pl, automatykab2b.pl, aps.pl., intechopen.com, Google Patents, Google Scholar.*
	5	*Wilson M., Implementation of robot systems: an introduction to robotics, automation, and successful systems integration in manufacturing. Butterworth-Heinemann, 2014.*

Course coordinator	*Ph.D., Eng. Roman Trochimczuk*	**Date:**	*20.02.2024*