Bialystok University of Technology, Faculty of Mechanical Engineering									
Field of study	*Mechatronics*							**Degree level and programme type**	*first-cycle (BSc, Eng) full-time studies*
Specialization/ diploma path	*Common course*							**Study profile**	*academic*
Course name	*Automation and robotization of processes*							**Course code**	*IS-FME-00240W*
								Course type	
Forms and number of hours of tuition	**L**	**C**	**LC**	**P**	**SW**	**FW**	**S**	**Semester**	*winter*
	30		*15*	*15*				**No. of ECTS credits**	*5*
Entry requirements	*Automation, Programming of control systems, Introduction to robotics*								
Course objectives	*Getting students acquainted with modelling and describing systems for automation and robotization of industrial processes. Teaching the principles of modelling discrete and continuous processes applied in various branches of industry, and of designing algorithms to control these processes. Students learn to model the course of industrial processes and to design switching systems, and also get to know the latest technologies for automation and robotization of industrial processes that make up the so-called 'smart factory' as well as the basics of automated production management systems and automation and robotization of processes according to the Fourth Industrial Revolution.*								
Course content	*Lecture: Trends in technological development. Automation and robotization of processes according to the Fourth Industrial Revolution. Principles and objectives of discrete and continuous process automation. Production management architecture. Programming methods. Process description methods. Programming languages and algorithms: Grafcet, SFC, GRAPH, operational networks, Petri nets. Finite-state machines. Switching systems. Elements of industrial process systems (measuring, executive control, communication and SCADA systems). Automation and robotization of selected production/technological processes. Automation of decision-making processes in production planning and execution. Hierarchical control system models. Understanding electrical and signal diagrams: automation systems: relays, contactors, coils, digital and analogue PLC I/O connections, safety and security elements. Robotic systems - construction, operation and control. Robots and manipulators in industrial processes (assembly, packaging, transport, etc.). Selection of robot and manipulator configurations. Flexible robotic production cells. Cooperation of robots and manipulators with humans. Hybrid systems. Designing flexible robotic systems. Decentralized control systems of robotic cells. Remote management of industrial robots. Project classes: designing control systems with the use of the Stateflow module of the Matlab/Simulink software. Designing control systems of the Bang-Bang type. Sequential system modelling. Modelling and designing control systems for selected industrial automation systems. Designing and investigating control systems with variable regulator structures. Designing and modelling control systems for selected manufacturing processes. Laboratory classes: Programming of selected robotic systems (robotic cells).*								
Teaching methods	*Information and problem lecture; Laboratory classes; Project classes*								
Assessment method	*Lecture: examination; Laboratory classes: evaluation of: self-preparation tests on specified issues before they are discussed during the course, students' reports, students' participation in discussions and their activity during classes; Project classes: evaluation of: students' projects, their ongoing work progress, participation in discussions and students' activity during classes*								

Symbol of learning outcome	**Learning outcomes Students who successfully complete the course:**	**Reference to the learning outcomes for the field of study**
LO1	*know the structure, components and operation of automated and robotized industrial processes*	*MK1_W03*
LO2	*know tools and methods for modelling and describing the course of automated and robotized industrial processes and for building control algorithms*	*MK1_W05, MK1_W06*
LO3	*know automation methods in production process management*	*MK1_W06*

LO4	*can create algorithms and program the execution of automated industrial processes, using different robot/manipulator configurations*	*MK1_U06, MK1_U10*
LO5	*can formulate assumptions, read wiring diagrams, and also draw supply and signal electrical connections and electro-mechanical/pneumatic/hydraulic connections*	*MK1_U07, MK1_U08*
LO6	*can critically evaluate their knowledge of automation and robotization of industrial processes*	*MK1_K01*
Symbol of learning outcome	**Methods of assessing the learning outcomes**	**Type of tuition during which the outcome is assessed**
LO1	*Lecture: examination*	*L*
LO2	*Lecture: examination*	*L*
LO3	*Lecture: examination*	*L*
LO4	*Laboratory classes: evaluation of: self-preparation tests on specified issues before they are discussed during the course, students' reports, students' participation in discussions and their activity during classes; Project classes: evaluation of: students' projects, their ongoing work progress, participation in discussions and students' activity during classes*	*LC, P*
LO5	*Laboratory classes: evaluation of: self-preparation tests on specified issues before they are discussed during the course, students' reports, students' participation in discussions and their activity during classes*	*LC*
LO6	*Lecture: examination; Laboratory classes: evaluation of: self-preparation tests on specified issues before they are discussed during the course, students' reports, students' participation in discussions and their activity during classes; Project classes: evaluation of: students' projects, their ongoing work progress, participation in discussions and students' activity during classes*	*L, LC, P*

Student workload (in hours)		**No. of hours**
Calculation	*Participation in lectures*	*30*
	Participation in laboratory classes	*15*
	Participation in project classes	*15*
	Preparation for examination based on lecture content; participation in examination	*16*
	Preparation for laboratory classes	*12*
	Preparation for passing the laboratory classes	*3*
	Preparation for project assignments	*19*
	Completion of project assignments (including preparation of presentations)	*5*
	Preparation for passing project assignments	*6*
	Participation in consultations	*4*
	TOTAL:	*125*

Quantitative indicators	**HOURS**	**No. of ECTS credits**
Student workload – activities that require direct teacher participation	*66*	*2.6*
Student workload – practical activities	*77*	*3.1*

Basic references	*1. Mikulczyński T., Automatyzacja procesów produkcyjnych: metody modelowania procesów dyskretnych i programowania sterowników PLC, PWN, Wyd. 2, Warszawa, 2017.* *2. Świder J. i inni, Sterowanie i automatyzacja procesów technologicznych i układów mechatronicznych: układy pneumatyczne i elektropneumatyczne ze sterowaniem logicznym PLC, Wyd. Politechniki Śląskiej, 2015.* *3. Kost G., Łebkowski P., Węsierski N., Automatyzacja i robotyzacja procesów produkcyjnych, Polskie Wyd. Ekonomiczne, Warszawa 2014.* *4. Honczarenko J., Roboty przemysłowe. Budowa i zastosowanie, WNT, Warszawa 2004.* *5. Barczyk J., Automatyzacja procesów dyskretnych. Oficyna Wydawnicza Pol. Warszawskiej, Warszawa 2003.*
Supplementary references	*1. Honczarenko J., Elastyczna automatyzacja wytwarzania. WNT Warszawa 2000.* *2. Laskowski J., Nowy poradnik elektroenergetyka przemysłowego, COSIW, SEP, Warszawa, 2010.* *3. Schwab K., The fourth industrial revolution, Penguin Random House, London, 2017.* *4. The MathWorks, Stateflow Toolbox for Matlab.*

Organisational unit conducting the course	*Department of Automatic Control and Robotics*	**Date of issuing the programme**
Author of the programme	*Arkadiusz Mystkowski, DSc, PhD, Eng*	*24.04.2019*
L – lecture, C – classes, LC – laboratory classes, P – project, SW – specialization workshop, FW - field work, S – seminar		