COURSE DESCRIPTION CARD

Faculty of Mechanical Engineering									
Field of study	**Mechatronics**							**Degree level and programme type**	**Bachelor**
Specialization/ diploma path	**Common course**							**Study profile**	
Course name	**Programmable Logic Controllers**							**Course code**	**IS-MER0040W**
								Course type	
Forms and number of hours of tuition	**L**	**C**	**LC**	**P**	**SW**	**FW**	**S**	**Semester**	**winter**
	30		**15**	**30**				**No. of ECTS credits**	**6**
Entry requirements									
Course objectives	Introduction of the rules of configuration, programming and operation of Programmable Logic Controllers (PLCs). Practical demonstration of the operation and functions of various types of PLCs, in LAD, STL and FBD languages. The subject includes programming combination and sequencing systems, binary control and industrial networking.								
Course content	Lecture - Discussion of the principles of operation and work cycle of PLCs. Discussion of data types and applications of: SET and RESET functions, timers, counters, logical and mathematical functions, bit operations, array operations and codes, modulated-fill pulse generators, PID regulators. Advanced PLC functions: PWM generators, motion control and high speed counters. System basics of distributed control. PLC communication functions. Introduction to industrial networks. Laboratory - Introduction to PLC programming in LD and exercises on PLC applications in engineering and industry. Project - Execution of design tasks in the field of PLC applications.								
Teaching methods	Problem-information lecture; Laboratory practice classes;								
Assessment method	Lecture: written test; laboratory exercises: evaluation of preparation of the students to the classes: short written tests, discussion during the classes, project: evaluation of the projects carried out, current progress of the work, discussions and activity in the classes Evaluation of the written reports.								

Symbol of learning outcome	Learning outcomes	Reference to the learning outcomes for the field of study
LO1	knows the design and operation of PLCs	**MK1_W03**
LO2	describes arithmetic and logic operations using STL, LAD and FBD languages	**MK1_W03, MK1_W04, MK1_W05**
LO3	defines and writes binary functions executed by the PLC	**MK1_W03, MK1_W04, MK1_W05**
LO4	can program controllers used in unit processes or operating in industrial networks	**MK1_U07, MK1_U08, MK1_U10**
LO5	is able to run and test complex binary control algorithms for PLCs and uses engineering terminology in this field	**MK1_U07, MK1_U10**
LO6	is aware of its responsibility for its own work and preparedness to submit to the teamwork rules	**MK1_U02, MK1_U03, MK1_K03**

Symbol of learning outcome	Methods of assessing the learning outcomes	Type of tuition during which the outcome is assessed
LO1	Lecture: written test	**L**
LO2	Lecture: written test	**L**
LO3	Lecture: written test	**L**
LO4	Laboratory: evaluation of entrance tests, reports, discussions and activity during classes; Project: evaluation of completed projects, current work progress, discussions and activity during classes	**LC, P**
LO5	Laboratory: evaluation of entrance tests, reports, discussions and activity during classes; Project: evaluation of completed projects, current work progress, discussions and activity during classes	**LC, P**
LO6	Laboratory: evaluation of entrance tests, reports, discussions and activity during classes; Project: evaluation of completed projects, current work progress, discussions and activity during classes	**LC, P**

Student workload (in hours)		No. of hours
Calculation	Lecture attendance	**30**
	Attendance in laboratory classes	**15**
	Attendance in projects	**30**
	Preparation for the lecture test; attendance at the test	**18**
	Preparation for the laboratory	**13**
	Preparation for the laboratory assessment	**2**
	Preparation for project tasks	**20**
	Carrying out project tasks (including presentation)	**10**
	Preparation for the project assignment assessment	**7**
	Office hours attendance	**5**
	TOTAL:	**150**

Quantitative indicators	HOURS	No. of ECTS credits
Student workload – activities that require direct teacher participation	**82**	**3,3**
Student workload – practical activities	**100**	**4**

Basic references	1. Nof, S.Y., 2009. Springer Handbook of Automation, Berlin: Springer. 2. Clements-Jewery, K. & Jeffcoat, B., 1996. The PLC Workbook : programmable logic controllers made easy, London: Prentice-Hall. 3. Bolton W., 2016, Programmable Logic Controllers. Burlington, Ma Newnes/Elsevier. 4. GE Fanuc Automation, 1999, Series 90™-30/20/Micro PLCCPU Instruction Set Reference Manual,.
Supplementary references	1. Dzierżek K., Programowanie sterowników GE Fanuc w przykładach i zadaniach, Wyd. Politechniki Białostockiej, 2007. 2. Świder J., i inni: Sterowanie i automatyzacja procesów technologicznych i układów mechatronicznych: układy 3. pneumatyczne i elektropneumatyczne ze sterowaniem logicznym PLC, Wyd. Politechniki Śląskiej, 2015. 4. Kwaśniewski J., Sterowniki PLC w praktyce inżynierskiej, BTC, 2014. 5. Sałat R., Korpysz K., Obstawski P., Wstęp do programowania sterowników PLC, WKiŁ, 2009. 6. Mikulczyński T., Automatyzacja procesów produkcyjnych: metody modelowania procesów dyskretnych i programowania sterowników PLC, WNT, 2009.

Organisational unit conducting the course	**Department of Robotics and Mechatronics**	**Date of issuing the programme**
Author of the programme	**Kazimierz Dzierżek, D. Sc. Eng.**	**20.04.2019**