FACULTY OF ELECTRICAL ENGINEERING

SUBJECT CARD

Name in Polish:	**Automatyzacja procesów przemysłowych**
Name in English:	**Automation of industrial processes**
Main field of study (if applicable):	**Control Engineering and Robotics**
Specialization (if applicable):	
Level and form of studies:	**1st level, full-time**
Kind of subject:	**optional**
Subject code:	**ARR043211**
Group of courses:	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU):	15		30		
Number of hours of total student workload (CNPS):	30		60		
Form of crediting:	crediting with grade		crediting with grade		
For group of courses mark (X) final course:					
Number of ECTS points:	1		2		
including number of ECTS points for practical (P) classes :			2		
including number of ECTS points for direct teacher-student contact (BK) classes:	0.70		1.40		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. He has knowledge of the theory of logic circuits.
2. It has knowledge of the structure of programmable controllers and understands their principles of operation.
3. It can connect the PLC to the control system.
4. He can develop a control algorithm of the selected industrial process.

SUBJECT OBJECTIVES

C1. Familiarize students with the structure of typical control systems in the industry.
C2. The acquisition of basic knowledge of popular communication networks used in industrial automation.
C3. Acquire the skills configure and programming of the selected PLC in distributed control systems.
C4. Acquiring skills: connection, configuration, programming and commissioning of advanced control system, which consists of several PLC connected via industrial communication networks.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01	It has knowledge of the structure of the industrial control systems.
PEK_W02	Knows the structure and principles of configuration and programming of the popular PLCs.
PEK_W03	Knows the connection topologies and understands the principles of operation of the popular industrial communication networks.

relating to skills:

PEK_U01	It can connect various industrial automation devices using standard communication networks.
PEK_U02	Is able to develop algorithms and write programs for PLCs, used for industrial process control.

relating to social competences:

PEK_K01	It has a sense of responsibility for their own work and a willingness to comply with the principles of teamwork.

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours:**
Lec 1	Introduction. Automation in the modern manufacturing plant. Structures of the industrial control systems.	2
Lec 2	Construction, hardware configuration and programming of selected programmable logic controllers - Part 1.	2
Lec 3	Construction, hardware configuration and programming of selected programmable logic controllers - Part 2.	2
Lec 4	Communication networks in industrial automation. Features of the PROFIBUS network.	2
Lec 5	Communication networks - continued. Data exchange in popular industrial networks.	2
Lec 6	Selected automation components used in integrated control systems.	2
Lec 7	Final test.	2
Lec 8	Monitoring and visualization of industrial processes.	1
	Total hours:	**15**

Form of classes - laboratory		**Number of hours:**
Lab 1	Introduction to the Rules and Regulations of internal safety lab. Establish rules for passing. General familiarization with laboratory equipment. Discussion of the laboratory exercises.	2
Lab 2	Hardware configuration and programming of the selected PLCs from SIMATIC Siemens family.	2
Lab 3	Programming of control systems of selected models of devices and industrial processes - Part 1.	2
Lab 4	Programming of control systems of selected models of devices and industrial processes - Part 2.	2
Lab 5	Programming of control systems of selected models of devices and industrial processes - Part 3.	2
Lab 6	Programming of analog input-outputs of selected PLCs.	2
Lab 7	Application of selected communication networks (PROFIBUS, AS-i, Ethernet) to exchange data between PLCs - Part 1.	2
Lab 8	Application of selected communication networks (PROFIBUS, AS-i, Ethernet) to exchange data between PLCs - Part 2.	2
Lab 9	Programming of distributed control systems - implementation of selected projects - Part 1.	2
Lab 10	Programming of distributed control systems - implementation of selected projects - Part 2.	2
Lab 11	Programming of distributed control systems - implementation of selected projects - Part 3.	2
Lab 12	Programming of distributed control systems - implementation of selected projects - Part 4.	2
Lab 13	Application a SCADA systems for visualization of industrial processes - Part 1.	2
Lab 14	Application a SCADA systems for visualization of industrial processes - Part 2.	2
Lab 15	Giving reports, summary and pass the lab.	2
	Total hours:	**30**

TEACHING TOOLS USED
N1. Lecture using audiovisual techniques, multimedia presentations.
N2. The laboratory is carried out in the traditional manner in student groups. Laboratory is equipped with: PCs, PLCs and the models of machinery, equipment and industrial processes.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT		
Evaluation *F – forming (during semester)* *P – concluding (at semester end)*	**Educational effect number**	**Way of evaluating educational effect achievement**
F1(W)	PEK_W01 PEK_W02 PEK_W03	Final test.
P(W)	P = F1	
F1(L)	PEK_U01 PEK_U02 PEK_K01	Assessment of prepare for laboratory exercises.
F2(L)	PEK_U01 PEK_U02 PEK_K01	Activity in laboratory classes.
F3(L)	PEK_U01 PEK_U02 PEK_K01	Rating of reports of completed projects.
P(L)	P = 0,2*F1+0,5*F2+0,3*F3	

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Kasprzyk J., Programowanie sterowników przemysłowych, WNT
[2] Legierski T., Wyrwał J., Programowanie sterowników PLC, Wyd. Pracowni Komputerowej J. Skalmierskiego, Gliwice 1998
[3] Pawlak M., Sterowniki Programowalne, e-skrypt, Wyd. Politechnika Wrocławska, Wrocław 2010, dostępny w Dolnośląskiej Bibliotece Cyfrowej

SECONDARY LITERATURE:

[1] Janusz Kwaśniewski, Sterowniki PLC w praktyce inżynierskiej, BTC
[2] Laboratory instruction set, auxiliary materials for lectures and technical documentation of PLCs.
[3] Weigmann J., Kilian G., Decentralization with PROFIBUS-DP, Publicis MCD Verlag, Erlangen 2000
[4] Solnik W., Zajda Z., Komputerowe sieci przemysłowe Profibus DP i MPI, Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2004.
[5] Mikulczyński T., Automatyzacja procesów produkcyjnych, WNT, 2009

SUBJECT SUPERVISOR

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
ARR043211 - Automation of industrial processes
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Control Engineering and Robotics**

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	K1AIR_AMPU_W03	C.1	Lec1 Lec6 Lec8	N.1
PEK_W02	K1AIR_AMPU_W03	C.1	Lec2 Lec3 Lec6	N.1
PEK_W03	K1AIR_AMPU_W03	C.1 C.2	Lec1 Lec4 Lec5 Lec6	N.1
PEK_U01	K1AIR_AMPU_U03	C.3 C.4	Lab2 Lab7 Lab8 Lab9 Lab10 Lab11 Lab12 Lab13 Lab14	N.2
PEK_U02	K1AIR_AMPU_U03	C.3 C.4	Lab2 Lab3 Lab4 Lab5 Lab6 Lab9 Lab10 Lab11 Lab12	N.2
PEK_K01	K1AiR_K09	C.1 C.2 C.3 C.4	Lec7 Lab1 Lab2 Lab3 Lab4 Lab5 Lab6 Lab7 Lab8 Lab9 Lab10 Lab11 Lab12 Lab13 Lab14 Lab15	N.1 N.2