

## MODULE DESCRIPTION

Module code	<b>Z-ZIP2-595z</b>
Module name	<b>Sterowniki PLC w systemach produkcyjnych</b>
Module name in English	<b>Manufacturing Systems with PLC Controllers</b>
Valid from academic year	<b>2016/2017</b>

## A. MODULE PLACEMENT IN THE SYLLABUS

Field of study	<b>Management and Production Engineering</b>
Level of education	<b>2nd degree</b> <i>(1st degree / 2nd degree)</i>
Studies profile	<b>General</b> <i>(general / practical)</i>
Form and method of conducting classes	<b>Full-time</b> <i>(full-time / part-time)</i>
Specialisation	<b>Management Engineering</b>
Unit conducting the module	<b>The Department of Automatics and Robotics</b>
Module co-ordinator	<b>Prof. Dariusz Janecki, PhD hab.</b>
Approved by:	

## B. MODULE OVERVIEW

Type of subject/group of subjects	<b>Specialist subject</b> <i>(basic / major / specialist subject / conjoint / other HES)</i>
Module status	<b>Compulsory</b> <i>(compulsory / non-compulsory)</i>
Language of conducting classes	<b>English</b>
Module placement in the syllabus - semester	<b>2nd semester</b>
Subject realisation in the academic year	<b>Winter semester</b> <i>(winter / summer)</i>
Initial requirements	<b>No requirements</b> <i>(module codes / module names)</i>
Examination	<b>Yes</b> <i>(yes / no)</i>
Number of ECTS credit points	<b>3</b>

<b>Method of conducting classes</b>	<b>Lecture</b>	<b>Classes</b>	<b>Laboratory</b>	<b>Project</b>	<b>Other</b>
<b>Per semester</b>	<b>15</b>		<b>15</b>		

### C. TEACHING RESULTS AND THE METHODS OF ASSESSING TEACHING RESULTS

<b>Module target</b>	The aim of the course is to provide students with knowledge of the organization and operation of production systems using PLCs. Students will gain skills in the selection and configuration of the PLC hardware, depending on the engineering task. Student will know more about PLC programming at the basic level.
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Effect symbol	Teaching results	Teaching methods (l/c/lab/p/other)	Reference to subject effects	Reference to effects of a field of study
W_01	The student has an elementary knowledge of the production systems organization using PLCs.	l	K_W04 K_W05 K_W10	T2A_W03 S2A_W06 T2A_W04
W_02	Student has an elementary knowledge of the digital signal processing.	l	K_W05 K_W12	T2A_W07 T2A_W09 S2A_W06 T2A_W05 S2A_W06
W_03	The student has a basic knowledge of the construction and operation of PLCs.	l	K_W06 K_W10	T2A_W06 T2A_W04
W_04	The student knows the rules and methods to configure the PLC hardware depending on the application in industrial production systems.	l	K_W05 K_W10	T2A_W07 T2A_W09 S2A_W06 T2A_W04
W_05	Student has knowledge of application development with use of ladder programming language.	l	K_W10	T2A_W04
U_01	Student is able to properly choose PLC hardware in order to it's application.	lab	K_U01 K_U03	T2A_U01 T2A_U08 T2A_U15 T2A_U17
U_02	The student is able to design and test a program written to the PLC. He can use the application to the PLC programming. (E.g. Proficy Machine Edition).	lab	K_U03	T2A_U08 T2A_U15 T2A_U17
U_03	Student is able to describe and solve engineering problem with use of ladder programming language.	lab	K_U03 K_U05 K_U07	T2A_U08 T2A_U15 T2A_U17 T2A_U04 T2A_U06 T2A_U07 T2A_U05 T2A_U09
U_04	The student is able to design and program the system consisting of at least 2 PLCs.	lab	K_U03 K_U05 K_U07	T2A_U08 T2A_U15 T2A_U17 T2A_U04 T2A_U06 T2A_U07 T2A_U05 T2A_U09
K_01	Can work in a group when solving engineering problems.	lab	K_K03	T2A_K03 T2A_K05 T2A_K07
K_02	He understands the need for continuous training in the rapidly growing field of industrial control systems	l	K_K01	T2A_K01 T2A_K06

## Teaching contents:

### 1. Teaching contents as regards lectures

Lecture number	Teaching contents	Reference to teaching results for a module
1	PLC in industrial production systems. Examples of application, basic concepts. The idea of automated production lines.	W_01
2	Boolean algebra - basic logic functions. Basics of digital signal processing.	W_02
3	Hardware architecture PLC : CPU , discrete input modules, analog input modules , discrete output modules , analog output modules , special modules (HART , HSC and others) , Introduction to Proficy Machine Edition software.	W_03 W_04 U_01
4	Basic commands of the ladder programming language.	W_03 W_04 W_05 U_02
5	Advanced commands of the ladder programming language.	W_03 W_04 W_05 U_02
6	Rules of application development, good programming habits.	W_03 W_04 W_05 U_03
7	PLC data transmission systems.	W_03 W_04 W_05 U_03 U_04
8	Design and programming Human Machine Interface in industrial control systems.	W_03 W_04 W_05 U_03 U_04 K_02

### 2. Teaching contents as regards classes

Class number	Teaching contents	Reference to teaching results for a module

### 3. Teaching contents as regards laboratory classes

Laboratory class number	Teaching contents	Reference to teaching results for a module
1	Proficy Machine Edition software design. Configuration development environment.	U_01
2	The basic elements of the ladder language - contacts and coils. Implementation of logic functions with use of ladder language.	U_01 U_02
3	Counters, timers, arithmetic and relationships in the ladder language.	U_02 U_03
4	Water supply system in the tank.	U_02 U_03
5	The production line - filling bottles of orangeade.	U_02

		U_03
6	Automatic washing machine.	U_02 U_03
7	Data transfer between controllers using EGD protocol.	U_02 U_03 K_01

#### 4. The characteristics of project assignments

### The methods of assessing teaching results

Effect symbol	Methods of assessing teaching results <i>(assessment method, including skills – reference to a particular project, laboratory assignments, etc.)</i>
W_01	<b>Exam.</b> Questions from the full range of the program lecture. Students grade depends on the number of points scored.
W_02	<b>Exam.</b> Questions from the full range of the program lecture. Students grade depends on the number of points scored.
W_03	<b>Exam.</b> Questions from the full range of the program lecture. Students grade depends on the number of points scored.
W_04	<b>Exam.</b> Questions from the full range of the program lecture. Students grade depends on the number of points scored.
W_05	<b>Exam.</b> Questions from the full range of the program lecture. Students grade depends on the number of points scored.
U_01	Hardware configuration test. Written application functionality test.
U_02	Hardware configuration test. Written application functionality test.
U_03	Hardware configuration test. Written application functionality test.
U_04	Hardware configuration test. Written application functionality test.
K_01	Observation of the student attitude during the laboratory classes.
K_02	Observation of the student attitude during the laboratory classes.

## D. STUDENT'S INPUT

ECTS credit points		
	Type of student's activity	Student's workload
1	Participation in lectures	15
2	Participation in classes	
3	Participation in laboratories	15
4	Participation in tutorials (2-3 times per semester)	5
5	Participation in project classes	
6	Project tutorials	
7	Participation in an examination	
8		
9	<b>Number of hours requiring a lecturer's assistance</b>	<b>40</b> <i>(sum)</i>
10	<b>Number of ECTS credit points which are allocated for assisted work</b> <i>(1 ECTS point=25-30 hours)</i>	<b>1.6</b>
11	Unassisted study of lecture subjects	12
12	Unassisted preparation for classes	
13	Unassisted preparation for tests	
14	Unassisted preparation for laboratories	9
15	Preparing reports	
15	Preparing for a final laboratory test	
17	Preparing a project or documentation	
18	Preparing for an examination	14
19		
20	<b>Number of hours of a student's unassisted work</b>	<b>35</b> <i>(sum)</i>
21	<b>Number of ECTS credit points which a student receives for unassisted work</b> <i>(1 ECTS point=25-30 hours)</i>	<b>1.4</b>
22	<b>Total number of hours of a student's work</b>	<b>75</b>
23	<b>ECTS points per module</b> <i>1 ECTS point=25-30 hours</i>	<b>3</b>
24	<b>Work input connected with practical classes</b> <i>Total number of hours connected with practical classes</i>	<b>29</b>
25	<b>Number of ECTS credit points which a student receives for practical classes</b> <i>(1 ECTS point=25-30 hours)</i>	<b>1.16</b>

## E. LITERATURE

Literature list	<ol style="list-style-type: none"> <li>1. Ge Fanuc PLC user manuals – Versa max micro, versa max and Pac system PLCs.</li> <li>2. Green C., Green C.H., <i>Learn How to Program and Troubleshoot Ladder Logic</i>, 1 edition (February 4, 2015).</li> <li>3. Petruzella F., <i>Programmable Logic Controllers</i>, 4th Edition, Published March 2nd 2004 by McGraw-Hil.</li> </ol>
Module website	