COURSE DESCRIPTION CARD - SYLLABUS

Course name

Programming of PLCs and industrial controllers

Course

Field of study

Automatic Control and Robotics

Year/Semester

4/5

Area of study (specialization)

Profile of study

general academic

Level of study

First-cycle studies

Course offered in

polish

Form of study

part-time

Requirements

compulsory

Number of hours

Lecture

18

Laboratory classes

18

Other (e.g. online)

0

Tutorials

0

Projects/seminars

0

Number of credit points

5

Lecturers

Responsible for the course/lecturer:

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Engineering

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Responsible for the course/lecturer:

Prerequisites

A student beginning this course should have basic knowledge of mathematical logic, basics of digital logic, basics of automation, electronics, use of programming tools in Windows operating system. He or she should have the ability to solve basic problems with the use of programming tools to perform control tasks and the ability to obtain information from indicated sources. In addition, in terms of social competence, the student must present such attitudes as honesty, responsibility, perseverance, cognitive curiosity, creativity, personal culture, respect for other people.

Course objective

1. To provide students with basic knowledge about programming and application of programmable

controllers in control processes, about algorithmization and writing a control program for the whole process (or one task) realized by a programmable controller, about using programming tools for control tasks.

2. To acquire the knowledge and skills to use programmable equipment for the realization of industrial process control, to acquire the ability to use the selected language intended for the programming of the control system, to acquire the ability to operate devices for the realization of digital control and tools used for the programming of industrial systems.

3. Developing students' skills in solving problems in the field of configuration, programming and use of industrial control systems.

Course-related learning outcomes

Knowledge

1. has basic knowledge of architectures and programming of microprocessor systems, knows selected high and low level microprocessor programming languages, knows and understands how to work;

2. has a structured knowledge of structures and principles of operation of analog and discrete control systems (open and feedback) and linear and simple non-linear controllers;

3. has a clear understanding of the structure and principles of operation of programmable industrial controllers and their analog and digital peripheral systems; knows and understands the principle of operation of basic communication interfaces;

4. is familiar with the basic methods, techniques, tools and materials used to solve simple engineering tasks in the field of automation and robotics;

Skills

1. is able to select parameters and settings of the basic industrial controller and configure and program the industrial programmable controller;

2. is able to assess the suitability of routine methods and tools for the design of automation and robotics systems, and to select and apply an appropriate method and tools;

3. is able to construct an algorithm for solving a simple measurement and calculation-control task and to implement, test and run it in a selected programming environment on the platform;

Social competences

1. is aware of the need for a professional approach to technical issues, scrupulous familiarization with the documentation and environmental conditions in which the equipment and its components can;

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The knowledge acquired during the lecture is verified by two 45-minute colloquia carried out during the 7th and 15th lectures. Each of the colloquiums consists of 10-15 questions (test and open questions), differently scored. The credit threshold: 50% of points. The credit issues on the basis of which the

questions are developed are made available to students using the university's e-mail system or the lecturer's website.

The skills acquired in laboratory classes are verified on the basis of three 15-minute tests or a 45-minute credit colloquium, consisting of 5-7 questions/tasks, which are scored differently depending on their level of difficulty. The credit threshold: 50% of points.

Programme content

The programme of the lecture (lecturer 2) includes the following issues:

W1. Introduction to control issues: the concept of control, realization of digital control of industrial processes, control system with a programmable controller, realization of control algorithm, input measurement and status signals, output control signals, classification of programmable controllers.

W2.Construction and operation of a PLC and a programmer. Modularity and its description, project configurations.

W3. Elements of programming the controller: programm memory, data memory, addressing, user memory areas and their representation, maps of representation of input and output states, numerical representation of words, types, variables, data location.

W4. Programming languages: ladder language - principles of creating logical connections in a ladder language, representation of operations and functions through graphic blocks, form of calling instructions, function or block, compilation and loading the program into the controller memory, structural text language - basic ST (SCL) constructions, operators, built-in functions, type conversions.

W5. Controller programming - definitions, parameters and examples of use: marker memory, data block memory, logical operations on bits and words, shift and rotation operations, functions of counting events and time counting, functions of comparing values and states, types and variables, ranges of numerical variables, arithmetic constant and floating point operations, mathematical functions, type converters. (Discussion based on ladder language).

W6. Procedural programming: design of program structure, design, creation, localization of data blocks, global and local data blocks, design and call functions, function blocks, formal, temporary and static variables, format of function arguments, system functions and system function blocks (system data blocks).

W7. Application of digital regulators: control algorithm, continuous and discrete regulators, two- and three-position regulators, programming of the regulator as a function block, parameterisation and use of built-in regulator blocks, testing of the control system with a digital regulator.

The programme of laboratory exercises:

C1. Presentation of controllers in laboratory configurations and discussion of the principles of their operation and communication with the programmer.

C2. Introduction to programming, building the project, hardware configuration, writing and starting the program in the chosen programming language, archiving the project.

C3. Using basic logical operations.

C4. Programming using time and counter relays.

C5. Programming with the use of comparators, data from a data block, execution of mathematical calculations, writing data to another block.

C6. Procedural programming with multiple function calls.

C7. Programming with the use of function blocks and data blocks.

Teaching methods

1. Lecture: multimedia presentation, presentation illustrated with examples given on the board.

2. Laboratory exercises: introduction to the task, programming the task and its verification, testing the results of the programme.

Bibliography

Basic

1. J. Kwaśniewski. Programowalny sterownik SIMATIC S7-300 w praktyce inżynierskiej, Wydawnictwo BTC, Legionowo 2009.

2. J. Kwaśniewski, Sterowaniki PLC w praktyce inżynierskiej, Wydawnictwo BTC, Legionowo 2008.

3. J. Kwaśniewski. Programowalne sterowniki przemysłowe w systemach sterowania, Wydawnictwo: Katedra Automatyzacji Procesów AGH, Kraków 1999.

Additional

1. SIMATIC, Programming with STEP7, Manual, Wydanie 5/2010, Siemens A.G.

2. Ladder Logic (LAD) for S7-300 and S7-400 Programming, Reference Manual, 6ES7810-4CA10-8BW1, 05.2010, Siemens A.G.

3. Simatic S7 Programowalny sterownik S7-1200, Podręcznik systemu, Wydanie 4/2009, Siemens A. G.

Breakdown of average student's workload

	Hours	ECTS
Total workload	125	5,0
Classes requiring direct contact with the teacher	36	2,0
Student's own work (literature studies, preparation for laboratory classes, preparation for exam) [1]	89	3,0

[1] delete or add other activities as appropriate