

COURSE TITLE: Programmable Logic Controllers
Institute/Division: Department of Automatic Control & IT / Faculty of Electrical and Computer Engineering
Course code: SP
Erasmus subject code: 0714 Electronics and automation
Number of contact hours: 45
Course duration: 1 semester basics/ or two semesters basic and advance course
ECTS credits: 6

Course description: The course consists of the lecture where basic knowledge about modern industrial control systems will be given as well as about topics like: analogue and digital devices, drives, hydraulic and pneumatic actuators, Programmable Logic Controllers, communication buses, PLC programming languages, hardware and software elements of the Programmable Logic Controllers, networking of PLCs, Human Machine Interface and its applications, SCADA systems. Some PLC applications, HMI applications and SCADA applications examples will be shown and explained.

The main part of the course are laboratory exercises in new PLC`s laboratory where participates will learn how to create functional PLC applications from bottoms-up. The prepared exercises will teach everything from PLC configuration, basic functions of the LAD and FBD languages, usage of timers and counters, creating sequence programs, programming of HMI screens, creating animations for HMI screens, connecting Android phones for controlling PLC.

All exercises are carried in practical way on sets of Siemens S7-1200 PLC and KNP600PN – HMI screens and connected training objects.

Prerequisites and additional requirements:

Basic knowledge about analogue and digital devices, drives and hydraulic and pneumatic actuators.

Description of learning outcomes for module:

Social competence: the course requires team work and active participation

Skills:

On successful completion of the Programmable Logic Controllers course you will be able to:

- Make a proper PLC modules configuration,
- Prepare a control program for any given control problem,
- Program PLC using LAD and FBD programming languages,
- Fault finding on PLC controlled systems
- Operate and program HMI screens,
- Make a HMI interface using Android systems device (phone) and control system using Android application

Knowledge:

On successful completion of the Programmable Logic Controllers course you will be able to:

- Describe the function and principles of operation of a Programmable Logic Controller (PLC) in industrial applications.
- Define the function and application of a PLC processor
- List, connect and describe digital and analogue input and output (I/O) devices and instrumentation
- Identify and explain different types of network modules used by PLCs.
- Detail and state the application of logic gates in PLC systems.
- Program, edit and test PLC programs incorporating combinational and sequential logic function, timers, counters and data handling instructions.
- Identify and convert between number systems and codes.
- Describe and understand how analogue and digital instrumentation connect to a PLC.
- Understand advanced programming techniques including functional block and statement list.

- List and produce the range of documentation required for successful completion of a PLC project.
- Fault find on PLC controlled systems with the aid of a laptop PC as a diagnostic tool.
- Understand what a Supervisory Control and Data Acquisition (SCADA) System is and how it communicates with a PLC network.

Assessment method:

For laboratory exercises assessment will be made after finishing given exercises and finishing bigger final course exercise. (practical assessment method)

- **Lecturers:** Łukasz Ścisło, E-3
- **Contact person:** Łukasz Ścisło, lscislo@pk.edu.pl

Course type: lectures (15h), laboratory (30h)

Literature:

- Programmable Logic controllers (PLC) - a practical guide , Collins-Lane
- Programmable Logic controllers (PLC) - F.D. Petruzella
- Practical SCADA for industry , David Balei, Edwin Wright
- Programmable logic controllers , W. Bolton
- Practical Modern SCADA Protocols, Clarke, Gordon, Reynders, Deon
- Fundamentals of Programmable Logic Controllers,
- Sensors, and Communications , Stenerson