COURSE DESCRIPTION CARD - SYLLABUS

Course name

Industrial transmission protocols

Course

Field of study

Automatic Control and Robotics

Year/Semester

2/3

Area of study (specialization)

Control and robotics systems

Profile of study

general academic

Level of study

Second-cycle studies

Course offered in

polish

Form of study

part-time

Requirements

elective

Number of hours

Lecture

12

Laboratory classes

12

Other (e.g. online)

0

Tutorials

0

Projects/seminars

0

Number of credit points

2

Lecturers

Responsible for the course/lecturer:

Jarosław Majchrzak, Ph.D. eng.

email: jaroslaw.majchrzak@put.poznan.pl

phone: 61 665 2847

Faculty of Control, Robotics and Electrical

Engineering

ul. Piotrowo 3, 60-965 Poznań

Responsible for the course/lecturer:

Prerequisites

Knowledge: A student beginning this course should have basic knowledge of: programming, construction and operation of programmable controllers, electric drives, basics of automation, basics of electronics, use of programming tools in Windows operating system.

Skills: The student should have the ability to solve basic problems with the use of programming tools to perform control and communication tasks and the ability to obtain information from indicated sources.

Social Skills: The student must present such attitudes as honesty, responsibility, perseverance, cognitive curiosity, creativity, personal culture and respect for other people.

Course objective

1. Providing students with basic and advanced knowledge of industrial communication technologies, in particular of the construction and operation principles of industrial network communication used in the implementation of measurements, control, configuration, parameterization and programming of automation and robotics devices, the use of programming tools to carry out communication tasks.

2. Acquiring knowledge and skills of applying selected communication systems, programmable equipment for the realisation of control of industrial processes, acquiring the ability to use the selected programming language intended for programming a control system using the selected communication system, acquiring the ability to operate tools used for programming industrial systems.

3. Developing in students the ability to solve problems in the field of programming and network communication in industry.

Course-related learning outcomes

Knowledge

1. has a structured knowledge of communication systems used in the automation of industrial processes;

2. has basic knowledge in the field of architectures and programming of industrial controllers, knows selected languages of high and low level programming of automation systems;

3. has knowledge of selected communication protocols and understands the principles of their operation;

Skills

1. is able to select and integrate elements of a specialized measurement and control system including: control unit, executive system, measurement system and communication modules;

2. is able to construct/assemble a network communication system for an engineering task and apply it in practice;

3. is able to design, implement and maintain an industrial local communication network;

Social competences

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

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 a 45-minute colloquium consisting of 8-10 questions, differently scored. The pass mark is 50% of the points. The coursework on the basis of which the questions are prepared will be sent to students via e-mail using the university's e-mail system.

Skills acquired during laboratory classes are verified on the basis of the assessment of the preparation for laboratory classes and protocols drawn up on time after each laboratory exercise.

Programme content

The programme of the lecture includes the following issues:

1. Introduction to industrial network communication issues: elements of communication in automation and robotics, communication interface, cooperation of measurement, control and executive elements in a distributed system, use of real-time system in control and communication.

2. Industrial communication networks: types of networks in an industrial communication structure, features of industrial networks, network operation schemes, communication interface of a controller, transmission media used in industry, standards in network communication, norms.

3. Configuration of network systems: basic and advanced network configuration tools, principles of communication network configuration and its interfaces, network configuration scheme and its physical, functional, hardware and software implementation, compatibility of network elements.

4. Profibus DP network and its use: Profibus DP against a standard reference model, physical layer, coding, network transmission modes, basic properties and service functions of the link layer, communication primitives, communication interface organisation, message structure, transmission rules, message types, functions of the Profibus DP network application layer available from the programmer level, data exchange rules, examples of configuration, parameterisation, programming and operation of Profibus DP networks.

5. Industrial Ethernet networks - Profinet: base protocols, network operation diagrams, communication channels, determinism - isochronous cycles, configuration diagrams, functions of the application layer for the Profinet network, cyclical and acyclical information transmission, examples of use.

The laboratory exercises are carried out in teams of 2-3 people, which use 6 workstations equipped with configured computer and communication equipment, programming tools and programmable controllers and devices with communication interfaces. Laboratory tasks consist in configuring hardware and software devices, writing a program for a controller or controllers, starting them and testing them until the correctness of operation is achieved.

The programme of laboratory exercises:

C1. Communication with many drives using Profibus DP protocol.

C2. Communication with executive devices using Profibus DP network connections.

C3. Communication with sensors and digital measuring devices using network connections.

C4. Transmission of process data from controller programs via Profibus DP networks.

C5. Transmission of process data from controller programs using the Profinet network.

C6. Diagnosis of the network connection using software functions.

Teaching methods

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

2. Laboratory exercises: programming of tasks and their launch on selected software and hardware platforms and testing for changing task parameters, case studies.

Bibliography

Basic

1. W. Solnik, Zb. Zajda, Sieć Profibus DP w praktyce przemysłowej. Przykłady zastosowań. Wydawnictwo BTC, Legionowo 2013.

2. K. Sacha, Sieci miejscowe PROFIBUS, Wydawnictwo MIKON, Warszawa 1998.

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

4. R. Fall, W. R. Stevens, TCP/IP od środka. Protokoły. Wydanie II. Wydawnictwo Helion, Gliwice 2013.

Additional

1. K. Krysiak, Sieci komputerowe. Kompendium. Wydanie II, Wydawnictwo Helion, 2005.

2. W. Wójtowicz, ANALIZA ROZWIĄZAŃ SIECI PRZEMYSŁOWYCH O OTWARTYM KODZIE OPARTYCH NA TECHNOLOGII ETHERNET, Studia Informatica, Vol. 32, No.3A(98), 2011.

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,0
Classes requiring direct contact with the teacher	24	1,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	26	1,0

[1] delete or add other activities as appropriate