



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

SCADA systems [S1AiR1>PO10-SCAD]

### Course

Field of study

Automatic Control and Robotics

Year/Semester

4/7

Area of study (specialization)

–

Profile of study

general academic

Level of study

first-cycle

Course offered in

polish

Form of study

full-time

Requirements

elective

### Number of hours

Lecture

15

Laboratory classes

30

Other (e.g. online)

0

Tutorials

0

Projects/seminars

0

### Number of credit points

3,00

### Coordinators

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### Lecturers

### Prerequisites

The student starting this subject should have a basic knowledge of automation, electrical engineering and electronics as well as mechanics. Should have the ability to solve basic problems in the automation and programming of PLC controllers and the ability to obtain information from the indicated sources. He should also understand the need to expand his competences. The student should demonstrate the ability to work in a team. In addition, in terms of social competences, students must present attitudes such as honesty, responsibility, perseverance, cognitive curiosity, creativity, personal culture, and respect for other people.

### Course objective

To provide students with basic knowledge of IT systems necessary for the design of automation systems and the visualization of industrial processes. Developing students' skills in solving design problems related to automation systems. Developing students' teamwork skills.

### Course-related learning outcomes

Knowledge

1. has elementary knowledge in the field of handling and use of IT tools for rapid prototyping and design, simulation and visualization of automation systems and systems - [K1\_W10]

2. has structured knowledge in the field of construction and operating principles of analog and discrete control systems - [K1\_W16]
3. knows and understands the construction and principle of operation of PLC controllers and their peripheral systems. Knows the principles of operation of communication interfaces and protocols used in control systems (eg CANOpen) - [K1\_W19]
4. knows the basic methods, techniques and tools used in solving simple project tasks in the field of automation - [K1\_W23]

- Skills
1. is able to determine and use models of simple industrial processes, as well as use them for the purposes of analysis and design of automation systems - [K1\_U11]
  2. is able to use selected tools for rapid prototyping of automation systems in the MATLAB / SIMULINK environment - [K1\_U13]
  3. can configure and program the industrial programmable controller - [K1\_U18]
  4. is able to assess the usefulness of routine methods and tools for the design of automation systems; can apply these methods in practice - [K1\_U24]
  5. is able to design and implement a visualization of a simple industrial process (in a selected SCADA environment) based on an industrial communication network - [K1\_U28]

- Social competences
1. is aware of the responsibility for own work and willingness to comply with the principles of teamwork and taking responsibility for jointly implemented tasks - [K1\_K3]
  2. is able to properly define priorities for the implementation of the task specified by him or other - [K1\_K4]
  3. is aware of the need for a professional approach to technical issues, meticulous reading of technical documentation, compliance with professional ethics - [K1\_K5]

### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Knowledge acquired during the lecture is verified by the colloquium carried out at the last lecture. The test consists of 10-12 questions. Passing threshold: 50% of points. Final issues, on the basis of which questions are prepared, will be sent to students by email.

Skills acquired as part of the laboratory are verified on the basis of the completed project related to the designed SCADA system. This project includes the addition of an industrial process visualization, security system (login), alarm system, drawing trends reporting. The pass threshold covers 50% of the points obtained from the project evaluation (evaluation of applications and documentation).

### Programme content

The lecture program includes the following topics:

1. Introduction: discussion of concepts in the field of automation and process control techniques, general requirements for automation and process control devices.
2. Modeling of automation systems: mathematical description of continuous automatic control systems, special features and mathematical description of digital control systems, synthesis of automatic control systems (automatic programming). The use of rapid prototyping as tools for designing automation systems, the use of MATLAB / SIMULINK for rapid prototyping of control systems.
3. Introduction to SCADA systems on the example of Wonderware software: a general overview of SCADA / HMI systems. Discussion of the construction and functionality of the Wonderware Platform and its integration with applications enabling production management.
4. InTouch as an environment enabling the design of visualization of industrial processes. Overview of the WindowMaker design environment and variables used in visualization design. Integration of the HMI InTouch application and the ArcestrA environment (stand-alone applications, managed, published). Manage InTouch applications (create new applications, import existing applications, export and publish). Using ArcestrA symbols (creating and managing symbols, using the ArcestrA Symbol Editor, configuring element and symbol properties).
5. Alarming: basic information about alarms and events, alarm configuration, displaying current and historical alarms, acknowledgment of alarms, analysis of alarm distribution for individual variables, service of alarm database.
6. Security of complex automation systems: various security levels will be discussed, such as client station security, application server security, historical data storage security, communication security with the PLC controller.
7. Communication with external applications and PLCs, DDE protocol, SuitLink, discussion of the OPC

server, configuration of communication interfaces enabling connection with a given PLC, definition of variables used for communication with variables of the controller or external application (eg Excel).

8. Comparison of InTouch environment with mapp View visualization technology.

Laboratory classes are conducted in the form of fifteen 2-hour exercises, held in the laboratory, preceded by a 2-hour instructional session at the beginning of the semester (introduction to the InTouch application and mapp View). Exercises are carried out by 2-person teams.

The laboratory program covers the following issues (individual issues are implemented simultaneously by all groups):

1. First steps in the InTouch application: setting up a new application, managing ArchestrA symbols, creating new symbols, creating scripts.
2. A practical introduction to mapp View visualization technology.
3. Simulation of a simple industrial process model operation: designing a visualization application of a given industrial facility and simulation of its work.
4. Communication with the PLC: configuration of the connection of the visualization application with the given PLC, design of the visualization for a given real object controlled by the PLC.

### Teaching methods

1. lecture: multimedia presentation,
2. laboratory exercises: practical exercises, discussion, teamwork.

### Bibliography

Basic

1. R. Jakuszczyński, Podstawy programowania systemów SCADA, 2010
2. R. Kwiecień, Komputerowe systemy automatyki przemysłowej, Helion
3. H. Kloust, Wybrane parametry urządzeń do automatyzacji, Biblioteka COSiW SEP, Warszawa, 2002
4. R. Williams, Handbook of SCADA systems, Elsevier Advanced Technology, 1st edition, 2001
5. D. Bailey, E. Wright: Practical SCADA for Industry, Elsevier, London, 2003

Additional

1. J. Korbicz, M. Kościelny, Z. Kowalczyk i W. Cholewa (Ed.): Diagnostyka Procesów. Modele. Metody Sztucznej Inteligencji. Zastosowania, WNT, Warszawa, 2002
2. M. Witczak, Sterowanie i wizualizacja systemów, Państwowa Wyższa Szkoła Zawodowa (Zeszyty Naukowe Automatyki i Robotyki; 1), Głogów, 2011
3. Technical documentation of the InTouch application.
4. Documentation of the mapp View visualization technology

### Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	45	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	30	1,00