COURSE DESCRIPTION CARD - SYLLABUS

Course name
Automated production systems [S1Log2>ZSP]

Course

Field of study
Logistics

Year/Semester
3/6

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
15

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

The student starting this subject should have basic knowledge of linear algebra, Boolean algebra, information technology and the basics of programming. He should also have the skills to obtain information from literature and technical documentation, work in a team and use IT tools, be aware of the risks when working with mechanical and electrical devices and have a sense of responsibility for the safety of other people.

Course objective

Presentation of theoretical and practical knowledge in the field of production automation and robotics.

Course-related learning outcomes

Knowledge:
1. Student knows the basic issues of design and principles of operation of automation and control systems [P6S_WG_01]

2. Student knows the basic issues of mechanics, construction and operation of industrial manipulators [P6S_WG_02]

Skills:
1. Student is able to use appropriate experimental and measurement techniques as well as software tools to solve a problem within the scope of automation and control [P6S_UW_03]
2. Student is able to notice their systemic and non-technical aspects, as well as socio-technical, organizational and economic aspects, when formulating and solving engineering tasks [P6S_UW_04]
3. Student is able to identify changes in requirements, standards, regulations, technical progress in the field of automation and control and, based on them, determine the need to supplement knowledge [P6S_UU_01]

Social competences:
1. student is aware of the initiation of activities related to the formulation and transfer of information and cooperation in society [P6S_KO_02]
2. Student is aware of the need to cooperate and work in a group to solve the problems posed [P6S_KR_02]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: The knowledge acquired during the lecture is verified by the 45-minute final test consists of 25-30 questions. Passing threshold 50% of points.
Laboratory: Skills acquired as part of the laboratory classes are verified on the basis of completed laboratory tasks and prepared protocols.

Programme content

The lecture and laboratory cover automation, automatic control systems (URA), elements and classification of URAs, tools for supervision of technological processes, programmable logic controllers (PLCs) and their programming languages, and SCADA systems.

Course topics

Lecture: The concept of automation, automatic control system, example systems, elements and classification of control systems, tools for supervision of technological processes, SCADA systems. Controllers: tasks of controllers, types and properties of controllers, bang-bang and double bang-bang controllers, continuous PID controllers, tuning of controller settings using selected techniques. Basic concepts of robotics, types and general construction of robots, tasks of industrial robots, coordinate systems, location representation, manipulator kinematics, manipulator programming and languages on the example of KUKA and Staubli robots. Construction and operation principle of programmable logic controllers (PLC), the sweep of the controller, input and output of controllers, programming languages, basics of programming in ladder language. Construction and operation of selected sensors and measuring devices used in automation and robotics.
Laboratory:
Introduction to the class. Discussion of health and safety rules of working in Room 720.
Programming with Structured Text (ST). Programme Illustrating the operation of a liquid tank.
Software illustrating the principle of a mixer, using ST language and an embedded controller simulator.
Lab 225MC
Introduction to the class. Discussion of health and safety rules working in the laboratory. Drive solutions powered by inverters frequency converters
Configuration and diagnostics of an industrial servo drive with motor PMSM in the AS environment: Familiarisation with the test bench and the B&R Automation Studio (AS) development environment (appendix: B&R environment); Creation of a project in the AS environment - communication with the controller; Configuration of the test bench components in the project, definition of the servo drive axis, Start-up of the axis using the TEST tool (appendix: B&R environment), Control of the axis using the SingleAx.ST program.
Testing the operation of industrial servo drives in axis synchronisation mode Position of the axes: Familiarisation with the test bench, Introduction and configuration of the test bench components in the project, Definition of the servo drive axes, Start-up and configuration of the axes using the TEST tool

(appendix: Environment R&D environment), Control of axes in synchronisation mode - Master/Slave. Programming of the model lift control system: Familiarising yourself with the test bench, Configuring the VLT Automation Drive inverter to work with the external control system, Checking the correct connection of control signals and sensors to the control system, creating a new project in AS, Configuring the I/O and assigning variables to them, writing a programme implementing the basic control modes of the lift.

Teaching methods

Lecture: informative lecture in the form of a multimedia presentation, conversational lecture
Laboratory: practical laboratory exercises

Bibliography

Basic:
1. Craig J.J., Wprowadzenie do robotyki: mechanika i sterowanie, WNT, Warszawa 1995.
2. Kostro J., Elementy, urządzenia i układy automatyki, WSiP, Warszawa 1998.
3. Tadeusiewicz R., Piwniak G.G., Tkaczow W.W., Szaruda W.G., Oprzędkiewicz K., Modelowanie komputerowe i obliczenia współczesnych układów automatyzacji, AGH, Kraków 2004.

Additional:
1. Springer Handbook of Automation, S.Y. Nof (Edytor), Springer, Cham 2009.
2. Kozłowski K., Dutkiewicz P., Wróblewski W., Modelowanie i sterowanie robotów, PWN, Warszawa 2003.
3. Michałek M., Kiełczewski M., Robustification of the modular tracking control system for non-Standard N-Trailers of uncertain kinematics, Control Engineering Practice, Vol. 64, 2017, s. 160-172.

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	20	1,00