COURSE DESCRIPTION CARD - SYLLABUS

Course name
Automatic and autonomous systems for production logistics [S2ZiIP2>AASLP]

Course

Field of study
Management and Production Engineering

Year/Semester
1/2

Area of study (specialization)
Production control

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
15

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

The student has basic knowledge of mechanics, electrical engineering, electronics, automation and structured theoretical knowledge in the field of study. The student knows what production logistics is. Knows the forms and types of production organization. Is able to use literature (obtaining knowledge from indicated sources) and the Internet.

Course objective

Acquiring knowledge about the structure and principles of operation of automatic and autonomous logistics systems used in manufacturing. Learning about solutions regarding mobile robots (AMR/AGV) and automatic logistics trains. Familiarizing students with solutions related to automatic warehouse systems and stacker cranes. Presentation of automatic unloading and loading systems and packaging systems. Acquiring knowledge about the basic components of such systems: propulsion system, control system, navigation and safety system. Showing the differences between an automatic and autonomous system. Presentation of safety analysis for an automatic and autonomous system.

Course-related learning outcomes

Knowledge:

The student has knowledge of the basic solutions used in industry regarding automatic and autonomous production logistics systems. The student knows what components such solutions consist of. Knows how to program mobile robots. Knows the limitations of current automatic and autonomous systems.

Skills:
The student has the ability to self-educate, including: in order to "improve" professional competences. Is able to conduct a safety analysis for a selected issue related to the implementation of an automatic logistics process
The student can program a simple mobile robot to carry out a logistics process.
The student is able to name the basic components of an automatic and autonomous logistics system.
The student can distinguish an automatic system from an autonomous one.

Social competences:
The student is aware of the social role of a technical university graduate, and especially understands the need to formulate and convey to society, in particular through the mass media, information and opinions regarding technological achievements and other aspects of engineering activities; makes every effort to convey such information and opinions in a generally understandable manner
The student is aware of the role of automation in modern industry and its importance for society and the environment, and is able to define priorities for implementing a specific automation task.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Written assessment of theory from lectures in the form of a test in electronic and conventional form consisting of 10-15 questions. Assignment of grades to percentage ranges of results: <90–100> very good; <80–90) good plus; <70–80) good; <60–70) satisfactory plus; <50–60) satisfactory; <0–50) unsatisfactory..
Ongoing monitoring of preparation for laboratories, optional final laboratory test in written form. Assignment of grades to percentage ranges of results: <90–100> very good; <80–90) good plus; <70–80) good; <60–70) satisfactory plus; <50–60) satisfactory; <0–50) unsatisfactory.

Programme content

1. Automation in production logistics
2. Design and application of tugger trains. Concept of milk-runner.
3. Automatic guided vehicles, autonomous mobile robots.
4. Stacker cranes and mobile racks
5. Safety in autonomous and automatic systems.
6. Sensors in AGV- and AMR-based systems.

Course topics

Lecture:
1. Automatic versus autonomous system in the context of production logistics
2. Construction of the mechanical component of mobile robots (AMR/AGV), automatic warehouse systems, stacker cranes and unloading and loading systems.
3. Automatic logistics train
4. Basic drive systems and their control methods
5. Measuring transducers: positions, velocities, accelerations used in AGV/AMR
6. Safety analysis and implementation of safety functions in automatic and autonomous systems
7. Navigation of mobile robots

Laboratory:
1. Construction and assembly of the mechanical component of a small-scale mobile robot
2. Assembly of the control component and commissioning of the small-scale mobile robot
3. Introduction to programming a small-scale mobile robot
4. Programming a small-scale mobile robot to perform basic logistics functions
5. Research on the safety system based on LiDAR scanners of an industrial mobile robot
6. Navigation of an industrial mobile robot using various systems

Teaching methods

Lectures and presentations, application examples, case studies (lab)

Bibliography

Basic:
1. Cook D., Budowa robotów dla początkujących, Helion, Warszawa, 2016.
2. Giergiel M. J., Hendzel Z., Żylski W., Modelowanie i sterowanie mobilnych robotów kołowych, Wydawnictwo Naukowe PWN, Warszawa, 2002
3. Kozłowski R., Sikorski A., Nowoczesne rozwiązania w logistyce, Wolters Kluwer Polska, 2013.

Additional:
Kagan E., Shvalb N., Ben-Gal I., Autonomous Mobile Robots and Multi-Robot Systems, Wiley, 2022.

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