COURSE DESCRIPTION CARD - SYLLABUS

Course name
Basics of automation [S1Mech2>PA2]

Course

Field of study
Mechatronics

Year/Semester
2/3

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
15

Other
0

Tutorials
15

Projects/seminars
0

Number of credit points

4,00

Coordinators

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Lecturers

Prerequisites

Mathematics in the field of set theory, complex numbers, differential equations, Laplace and Fourier transforms. Fundamentals of electrical engineering (RLC elements, electrical circuits) and mechanics (kinematics and dynamics of mechanical elements)

Course objective

Learning the principles of describing automation systems. Laplace'a transfer. Acquiring knowledge about basic linear elements and their connections, including the description of their dynamics and step responses. Knowledge and ability to determine the operator transfer functions of automation systems. Acquiring knowledge about PID controllers and their applications. Familiarization with methods of assessing the quality of regulation. Knowledge of determining the frequency characteristics of automation components and systems and determining their stability. Knowledge of logical operations and binary functions and their practical implementations.

Course-related learning outcomes

Knowledge:
Knows the basic concepts, structure, construction and operation of automation systems. Knows what

linear automation elements are and how to describe them and knows their operator transfer functions and step responses.
Knows what a PID controller is and what its descriptions and step responses are. Knows what the PID parameter dibir methods are and what the control quality indicators are.
Knows what frequency characteristics are and how to determine them. Knows the concept and methods of stability testing

Skills:
Can describe basic linear automation components. Can determine their transmittances and step responses of automation components and systems.
Can apply a PID controller and select its parameters. Can determine the quality of regulation.
Can determine the frequency characteristics of basic components.
Can determine the stability of an automation system, including its margin.

Social competences:
Understands the need for lifelong learning; can inspire and organize the learning process of other people
He/She is aware of the role of automation in the modern economy and its importance for society and the environment
Can define priorities for the implementation of a specific task

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

EXAM: Passed on the basis of an examination consisting of 5 general questions (for a correct answer to each question - 1 point. Grading scale: less than 2.6 points - 2, 2.6 ÷ 3.0 - 3.0, 3.1 ÷ 3.5 points - 3.5, 3.6 ÷ 4.0 points - 4.0, 4.1 ÷ 4.5 points - 4.5, 4.6 ÷ 5.0 points - 5.0 very good)
Laboratory: Credit based on the correct implementation of exercises and reports on each laboratory exercise according to the instructions of the laboratory teacher. Before the exercises, short entrance tests, and after the exercises, a written final test. In order to pass the laboratories, all exercises must be passed (positive grade from the answers and the report).
Classes: Assessment based on the final test.

Programme content

Description of the dynamics of continuous objects. Step responses. PID and two-state controllers. Frequency characteristics.

Course topics

1. Description of automation objects. Laplace transform. Input signals: pulse, step, rising signal.
2. Linear automation elements, their operator transfer functions and step responses.
3. Examples of mechanical and electrical linear elements. Creating and transforming block diagrams.
4. PID controllers - describing equations and step responses. Basics of PID controller selection.
5. Evaluation of automatic control system operation - quality of control. Frequency characteristics of linear automation elements.
6. Amplitude-phase and logarithmic characteristics. Stability. Methods of assessing stability, phase and amplitude margin.
7. Two-position control. Basics of nonlinear systems

Teaching methods

Lectures and presentations of models and simulations performed in the Matlab-Simulink environment

Bibliography

Basic:
1. Andrzej Dębowski, Automatyka Podstawy teorii, 2018 Wydawnictwo Naukowe PWN, WNT.
2. Poradnik Mechatronika, wyd. REA [2015] .
3. Urbaniak A., Podstawy automatyki. Wyd. PP.
4. Findeisen W., Technika regulacji automatycznej.

Additional:
1. Kindler H., Buchta H., Wilfert H., Zadania z techniki regulacji automatycznej.
2. Parszewski Z., Laboratorium teorii maszyn i regulacji automatycznej.

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	47	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	53	2,00