COURSE DESCRIPTION CARD - SYLLABUS

Course name
Modeling of mechatronic devices

Course

Field of study
Mechatronics

Year/Semester
1/2

Area of study (specialization)

Profile of study
general academic

Level of study
Second-cycle studies

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
30	15	
Tutorials	Projects/seminars	

Number of credit points

3

Lecturers

Responsible for the course/lecturer:
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Responsible for the course/lecturer:

Prerequisites

Fundamentals of machine construction, fundamentals of automation, machine dynamics, drives and sensors. Designing mechanical and electronic systems. Description of the automated elements. Understands the importance of mechatronics for the development of the country's economy.

Course objective

Acquiring the ability to formulate equations describing mechatronic devices and to develop their simulation models. Expanding the knowledge and skills of designing mechatronic devices with the use of modeling techniques.

Course-related learning outcomes

Knowledge

Knows how to theoretically describe the static and dynamic properties of mechanical, electrical and electronic elements.

Has knowledge of computer modeling software: Matlab / Simulink, Scilab.

Knows how to build a simulation model of a mechatronic device and conduct its simulation tests in order to improve its parameters and design.

Skills

He/She can describe theoretically and model components and the entire mechatronic device

He/She can conduct simulation tests of a mechatronic device

Is able to use the simulation results to design mechatronic devices

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 electronics in the modern engeneering and its importance for society and the environment

He/She can think and act creatively, especially in the field of designing mechatronic devices

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

EXAM: Passed on the basis of an writin test consisting of 3 general questions (for a correct answer to each question - 1 point. Grading scale: less than 1.6 points - 2, 1.6 ÷ 1.8 - 3.0, 1.9 ÷ 2.1 points - 3.5, 2.2 ÷ 2.4 points - 4.0, 2.5 ÷ 2.7 points - 4.5, 2.8 ÷ 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).

Laboratory topics:

1. Modeling of basic mechanical members

2. Modeling of connections of mechanical blocks, forming a robot, machine tool, etc.

3. Modeling of the basic electric components of the LRC and the DC motor

4. Nonlinear modeling: friction, backlash, saturation, deadband, etc.

5. Modeling of PID and two-position controllers as well as control systems

6. Modeling of the rotary table

7. Completion of the course

Programme content

Lectures:

1. Construction of mechatronic devices. Basics of modeling. HIL, SIL

2. Getting to know the possibilities of functional blocks of the Simulink and Scilab systems. Simulation parameters.

3. Description and modeling of basic mechanical linear members of a mechatronic device

4. Description and modeling of basic electric linear members of a mechatronic device

5. Description and modeling of the most important nonlinearities: friction, clearance, dead zone, saturation, hysteresis

6. Mathematical description and model of DC and stepper motors

7. Modeling of PID and two-position controllers

8. Description and modeling of the drive with PMSM motor

9. Modeling of electro-hydraulic elements, including the servo drive

10. Examples of models of various devices.

11. Simulation tests of the influence of construction parameters, drives, measurements

12. Research on the influence of the regulator on the properties of selected devices.

13. Research on the influence of the drive on the device

14. Examples of using simulation to design mechatronic devices.

15. Completion of the course

Teaching methods

Lecture with presentations, examples. Demonstration of model building and simulation. Explanations on the board

Bibliography

Basic

1. Heimann B., Gerth W., Popp K. Mechatronik, Carl Hanser Verlag, 1998 .

2. Mechatronic Systems Design Methods, Models, Concepts, Janschek, Klaus 2012

Additional

Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, W. Bolton, 2015

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,0
Classes requiring direct contact with the teacher	45	2,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	30	1,0

[1] delete or add other activities as appropriate