COURSE DESCRIPTION CARD - SYLLABUS

Course name
Artificial Intelligence Methods in Control

Course

Field of study
Mechatronics

Year/Semester
4/7

Area of study (specialization)
-

Profile of study
general academic

Level of study
First-cycle studies

Course offered in
English

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
15

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

2

Lecturers

Responsible for the course/lecturer:
prof. DSc. PhD. Eng. Andrzej Milecki

Responsible for the course/lecturer:
PhD. Eng. Dominik Rybarczyk

Prerequisites

Set theory, matrix calculus, basics of automation. Performing operations on matrices, operating on sets, basics of designing control systems, programming in C. Understands the need to learn and gain new knowledge

Course objective

Getting the knowledge about the methods of artificial intelligence and the possibility of their application in control.

Course-related learning outcomes

Knowledge

Knows the structure and operation of artificial neurons and unidirectional and recursive artificial neural networks

Knows the methods of learning artificial neurons and artificial neural networks, including deeply learned ones

Knows the limitations of artificial neural networks and knows what control tasks they can be used for

Knows the basics of fuzzy logic and the construction of fuzzy drivers

Knows the operation of genetic algorithms and the possibilities of their application

Skills

Can choose a neural network and prepare data for its training, e.g. in Matlab environment

Can use artificial neural networks for pattern recognition and control

Can design and program a fuzzy controller

Is able to use a genetic algorithm for simple optimization, e.g. of controller parameters

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 artyficial intelligence in modern engeneering 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).

Programme content

Introduction: the basics, benefits and threats of artificial intelligence.

Natural neuron. Artificial neuron and its model. Methods of learning neurons. Possibilities and limitations of the neuron. Artificial neurons: perceptron, adaline, Hebba and others. Nuer program.

Review of types of neural networks. Back propagation method. Applications of neural networks for pattern recognition and modeling. Deeply learned neural networks, RL method

Sets, numbers and fuzzy relations. Basic operations on fuzzy sets. Fuzzy drivers: fuzzification, inference and sharpening. Fuzzy driver program.

Construction, operation and types of fuzzy drivers. Examples of fuzzy drivers.

Operation and implementation of genetic algorithms. Application examples.

Lab:

1. Investigations of neurons

2. Study of learning neural networks

3. Examination of neural networks in control

4. Fuzzy methods

5. RL method in control

6. Fuzzy regulator

Teaching methods

Lectures and presentations. Examples and their implementation

Bibliography

Basic

Artificial Intelligence: A Modern Approach Paperback , 2015 S. Russell

Additional

Machine Learning An Artificial Intelligence Approach, Michalski, R.S., Carbonell, J.G., Mitchell, T.M.

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,0
Classes requiring direct contact with the teacher	30	1,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	20	1,0

[1] delete or add other activities as appropriate