COURSE DESCRIPTION CARD

BIALYSTOK UNIVERSITY OF TECHNOLOGY		**Faculty of Engineering Management**	
Field of study	Erasmus	**Level and form of study**	first degree/second degree
A group of modules /specialty		**Education profile**	acedemic
Course name	Methods of artificial intelligence	**Course code**	IS-FM-00119S
		Course type	
Course form(s) and number of hours	**L C LC P SW FW S** 15 15	**Semester** **ECTS credits**	**summer** **6**
The programme is valid from	2025/2026		
Introductory courses	-		
Course objectives	The course aims to familiarize students with selected artificial intelligence methods and techniques, including neural networks and expert systems, that support business decision-making. Throughout the course, students will develop practical skills in building simple neural models and applying them to solve real-world business problem		
Framework programme content	Concept of intelligence and artificial intelligence. Structure and operation of an artificial neuron. Activation functions. Concept of an artificial neural network. MPL, RBF and recurrent networks. Supervised and unsupervised training of artificial neural networks. The backpropagation algorithm. The structure and operation of expert systems. The concept of a knowledge base. Facets, rules and facts. Knowledge representation methods. Inference algorithms in expert systems.		
Other information about the course	-		
	the course is related to the scientific activity conducted at the University		

Calculation:

Student workload related to:	**Total number of hours**	**including contact**	**including practical**
participation in lectures	15	15	
participation in classes	15	15	15
literature studying	20	20	
participation in consultations	5	5	3
preparation for passing a lecture	20	0	0
preparation for practical classes	30		
solving practical problems	25		25
final report elaboration	20		20
Total number of hours:	**150**	**55**	**63**
Total number of ECTS credits:	**6**	**2,2**	**2,5**

Expected discipline learning outcomes	Knowledge	Skills	Social competence

Objectives and framework content prepared by	Julia Siderska, PhD	Date:	13.03.2025

Implementation in the academic year **2025/2026**

Programme content

	Lecture
1	Introduction to the subject (content, objectives, learning outcomes, assessment rules, literature). Definition of intelligence. Types of intelligence.
2	The concept of artificial intelligence. Classification of artificial intelligence. Subfields of artificial intelligence. History of the development of artificial intelligence.
3	The structure and characteristics of the brain. The biological nerve cell of a human. The structure and operation of an artificial neuron.
4	Activation functions. The structure and operation of a perceptron. The concept of an artificial neural network. MPL, RBF and recurrent networks.
5	Factors determining the operation of a neural network. Properties and applications of artificial neural networks.
6	Supervised and unsupervised training of artificial neural networks.
7	Algorithms for training artificial neural networks. Error backpropagation algorithm.
8	Rules for training neural networks.
9	Data representation in neural networks. Selection of the structure of a neural network. VCDim measure.
10	Measures of learning accuracy. Generalization and accuracy.
11	Introduction to expert systems. Knowledge engineering, knowledge acquisition.
12	Methods of knowledge representation in the knowledge base. Inference algorithms.
13	Building expert systems - facets, rules, facts; classification of expert systems.
14	Ethical and social challenges related to artificial intelligence. Challenges related to AI in the labor market.
15	Written test.
	Classes
1	Introduction to the environment of building artificial neural networks.
2	Selection of network architecture and its parameters, selection of the learning method and network training,
3	Selection of network architecture and its parameters, selection of the learning method and network training,
4	Building regression models for solving problems in business practice.
5	Building regression models for solving problems in business practice.
6	Building classification models for solving problems in business practice.
7	Building time series models for solving problems in business practice.
8	Practical exercises, building neural models, testing neural networks.
9	Building a database for the training process.
10	Solving selected problem tasks (simulating the best network architecture).
11	Work on solving selected problem tasks (simulations and testing of network quality).
12	Experiments with custom predictions.
13	Elaboration of the reports.
14	Presentation of the results of solving problem tasks in the field of neural networks, public discussion.

	15	Presentation of the results of solving problem tasks in the field of neural networks, public discussion.
Teaching methods (on-site classes)	L	Problem-based lecture, lecture with multimedia presentation
	C	Practical and activating methods (individual work and working in small groups)
Teaching methods (online classes)	L	Problem-based lecture, lecture with multimedia presentation
	C	Practical and activating methods (individual work and working in small groups)
Forms of crediting	L	Written test
	C	Assessment of tasks solved by students in small groups
Conditions of crediting	L	Written test in the form of open questions. The grade is given according to the following scheme: 51%-60% of the total number of points - 3.0; 61%-70% of the total number of points - 3.5; 71%-80% of the total number of points - 4.0; 81%-90% of the total number of points - 4.5; 91%-100% of the total number of points - 5.0.
	C	Point evaluation of the developed artificial intelligence tool. The condition for passing is obtaining more than 50% of the possible points. 51-60% ograde 3.0; 61-70% grade 3.5; 71-80% grade 4.0; 81-90% grade 4.5; 91-100% grade 5.0.

Outcome symbols	**Expected learning outcomes**	**Expected learning outcomes defined for the field of study**		
		Knowlegde	Skills	Social competence
	Knowledge: the student knows and understands			
E1	the construction and operation of neural networks and algorithms for training them, and the areas of using neural networks in business practice			
E2	principles of operation and construction of expert systems and inference algorithms, as well as possibilities of using them in business practice			
	Skills: the student can			
E3	design a neural network model, select its architecture, assess its quality and train it using an appropriate training algorithm			
E4	draw conclusions regarding digital business practice and make business decisions using developed artificial intelligence tools			
	Social competence: the student is ready to			
E5	critically evaluate developed skills in designing artificial intelligence tools and demonstrate openness to cooperation in this area			

Outcome symbols	**Methods of verification of learning outcomes**	**Course form subject to verification**
E1	Written test	L
E2	Written test	L
E3	Assessment of tasks solved by students in small groups	C
E4	Assessment of tasks solved by students in small groups	C
E5	Assessment of tasks solved by students in small groups	C

Basic references	1	Surma J., Business Intelligence. Making Decisions Through Data Analytics, Business Expert Press, 2011.
	2	Tuffery S., Data mining and statistics for decision making, Wiley, 2011.
	3	Ünal, Muhammet ; Ak, Ayça ; Topuz, Vedat ; Erdal, Hasan, Artificial Neural Networks, Studies in Computational Intelligence, Optimization of PID Controllers Using Ant Colony and Genetic Algorithms, 2013, pp.5-17
Supplementary references	1	Rutkowski L., Computational Intelligence: Methods and techniques, Springer, 2008.
	2	Parkes, D. C., and M. P. Wellman. 2015. “Economic Reasoning and Artificial Intelligence.” Science 349 (6245) (July 16): 267–272.

Course coordinator	Julia Siderska, PhD	**Date:**	13.03.2025