Study program: Mechatronics, IT in Mechanical Engineering, Engineering Management, Computer and Software Engineering, Information Technology

Type and level of studies: Undergraduate Academic Studies

Course unit: Intelligent Modeling and Control

Teacher in charge: Nedeljko G. Dučić

Language of instruction: English

ECTS: 6

Prerequisites: -

Semester: Summer

Course unit objective:
Acquaintance of students with computer intelligence techniques: neural networks, fuzzy logic, genetic algorithms, and training for application in solving various engineering problems of modeling, optimization and control
.

Learning outcomes of Course unit:
The student functionally lists and explains the types of computer intelligence techniques and the possibilities of application in solving various engineering problems. The student uses the possibilities of computer intelligence for modeling, optimization and control of processes and systems. Analyzes the effectiveness of the computer tools used to solve such tasks and bases the choice of tools on efficiency criteria.

Course unit contents:

Theoretical classes

• Computer intelligence.
• Artificial neural networks (Neuron and neuron model. Architecture and learning of artificial neural networks. Algorithm with back propagation of error. Application of neural networks in the approximation of nonlinear functions).
• Fuzzy systems (Theory of fuzzy sets. Approximate reasoning. Structure of fuzzy controllers).
• Genetic algorithms (Generation of initial population. Objective function. Genetic operators. Genetic algorithm parameters.)
• Swarm intelligence (Generation of the initial population. Objective function. Parameters of the optimization technique of swarm intelligence.).
• Hybrid intelligent systems (neuro-fuzzy systems).

Practical classes

• Designing neural networks with specialized software tools, for solving engineering problems of different classes.
• Solving optimization problems using genetic algorithms and swarm intelligence using specialized software tools.
• Designing phase and neuro phase control structures.

Literature:

[1] Jung, A., Machine Learning: Foundations, Methodologies, and Applications, Springer Nature Singapore Pte Ltd. 2022.

[2] Hagan T.M., Demuth B.H., Beale H.M., De Jesús O., Neural network design (2edition), Martin Hagan; 2 edition (September 1, 2014).

[3] Zilouchian, A., Jamshidi, M., Intelligent Control Systems Using Soft Computing Methodologies, CRC Press LLC, 2001.

Number of active teaching hours: 4	**Lectures: 2**	**Practice: 2**

Teaching methods:
Lectures, calculation exercises, consultations

Evaluation (maximum number of points 100)

Exam prerequisites:	No. of points:	**Final exam:**	No. of points:
Activities during teaching process	10	Final exam (written):	20
Practical teaching		Final exam (oral):	30
Colloquium			
Project	40		