UNIVERSITY OF TUZLA UNIVERZITET U TUZLI

SYLLABUS

1. Course title:

Neural networks

2. Code:

3. Cycle of study:

4. ECTS credits:

3

5. Type of course:

Elective

6. Prerequisites:

No

7. Class restrictions:

No

8. Duration / semester(s):

I | VII

9. Weekly contact hours and student workload:

Semester (1)	VII	Semester (2)		(for two-semester courses)	Workload: (hours)	
9.1. Lectures	2				Classes:	33.75
9.2. Seminars	0				Individual work:	54.17
9.3. Laboratory / Practice classes	1				In total:	87.92

10. Faculty:

Faculty of Mechanical Engineering

11. Department/study program:

Mechatronics

12. Lecturer:

Dr. Sc. Mirza Bećirović, assistant professor

13. Course aims:

The main goal of teaching the subject "Neural Networks" is the application of neural networks in the control processes of mechatronic systems, i.e. in robotics. Mastering the necessary theoretical and practical skills in the field of study of the subject in order to increase knowledge in the field of control of mechatronic systems using artificial intelligence, as well as the competitive advantages of mechatronic systems that are built into the control system of neural network algorithms.

14. Learning outcomes:

At the end of the semester/course, successful students, who have continuously performed their duties throughout the entire teaching period, will be able to understand the possibilities of controlling and regulating mechatronic systems using artificial intelligence, i.e. neural network algorithms.

15. Course content:

1. Basic concepts of artificial intelligence, i.e. neural networks, similarities between biological and artificial neurons.
2. Basic characteristics and structure of neural networks.
3. Types of neural networks (static and dynamic neural networks).
4. Neural network learning process.
5. Neural network learning process.
6. Examples of neural network applications.
7. Test I.
8. Convolutional neural networks.
9. Recurrent neural networks.
10. Autoencoders, ELMo.
11. BERT and generative networks with GAN adversary.
12. Implementation of neural networks.
13. Application of artificial neural networks in mechatronic system control processes.
14. Application of artificial neural networks in mechatronic system control processes.
15. Test II.

16. Learning methods:

Lectures, laboratory exercises, seminar work and consultations.
- Lectures using multimedia tools, active learning techniques and with active participation and discussions of students;
- Laboratory exercises, solving practical problems related to the topic of the studied subject, active two-way communication student - assistant (software simulation of the application of artificial neural networks in the processes of controlling mechatronic systems).
- Seminar work (independent work of the student on research into the development of neural networks and its application in mechatronics)
- Consultations (five hours per week);

17. Assessment methods:

The methods of knowledge assessment are: tests, seminar paper and final exam.
• Theory tests are a form of continuous assessment in which students solve theoretical questions from certain areas. During the semester, students solve 2 theory tests. For each test, a student can earn up to 20 points, which makes a total of a maximum of 40 points. In order to successfully pass the test, a student must earn a minimum of 10 points from each test.
• Students take the test from assignments in the last week of classes with a subject assistant. A student can earn a maximum of 30 points on the test. In order to successfully pass the test, a student must earn a minimum of 15 points from the test assignments.
• During the semester, students write a seminar paper and take a colloquium with a subject assistant. A student can earn a maximum of 10 points for writing a seminar paper.
• The student takes the final exam in writing/oral after previously fulfilling the conditions related to regular attendance and activity in classes and laboratory exercises, where they can earn a maximum of 20 points. The final exam consists of theoretical questions.
To pass the course, a student must achieve a minimum of 54 cumulative points.

18. Assessment components:

The grade on the exam is based on the total number of points that the student earned by fulfilling pre-exam obligations and passing the exam, as follows:

Pre-examination requriements
Test I 20
Test II 20
Test - tasks 30
Seminar paper 10

Total pre-examination requriements 80
Final exam 20

Total maximum points 100

Grading scale is as follows:

Grade	Description	Letter/Points
5 (five)	Does not meet minimum criteria	F <54
6 (six)	Meets minimum criteria	E 54-64
7 (seven)	Generally good, but with significant shortcomings	D 65-74
8 (eight)	Average, with noticeable errors	C 75-84
9 (nine)	Above average, with some errors	B 85-94
10 (ten)	Exceptional with no or minor errors	A 95-100

19. Mandatory reading list:

1. Z. Miljković, D. Aleksendrić.: "Veštačke neuronske mreže - zbirka rešenih zadataka sa izvodima iz teorije", Univerzitet u Beogradu, Mašinski fakultet, 2018.
2. M. A. Khan, S. S. Tinny, P. Ranjan, V. Shah.: "Deep Learning", 2024.

20. Additional reading list:

1. M. H. Beale, M. T. Hagan, H. B. Demuth.: "Neural network toolbox - Matlab", 2018.

21. Web sources:

22. Applicable from the academic year:

2025/2026

23. Adopted in the Faculty/Academy session: