Óbuda University Bánki Donát Faculty of Mechanical and Safety Engineering	Institute of Mechatronics and Vehicle Engineering

Subject title and code: **Fuzzy systems, BMXFRE2MNF** **Credits:** *4*

Full-time study 2025/2026 *ac.* 2 *semester*
year

The course is available at: mechatronical engineering

Supervised by: Prof. Dr. Ludányi-Laufer Edit	**Instructors:** Dr. habil Zsolt Csaba Johanyák

Prerequisite (neptun code): -

Weekly number of lessons

Lecture: 2	Group seminar: 1	Lab: 0	Consultation:

Way of assessment: Exam (Written and oral)

Online consultation *(in case it's required):* *... (BBB link)*

Educational goal: To develop a solid theoretical and practical understanding of fuzzy thinking within computational intelligence by introducing the core concepts and the operation of fuzzy inference systems in both single-level and hierarchical forms. The course covers fuzzy decision support, multi-criteria decision making, and practical work with the MATLAB Fuzzy Logic Designer toolbox. It also provides a brief overview of neural networks and nature-inspired algorithms as key soft-computing methods. A central goal is to strengthen students' problem-solving skills, culminating in the development of an independent fuzzy system.

Schedule

Education week	**Topics**
1	Introduction to soft computing.
2	Comparison of classical crisp and fuzzy set theory.
3	Specification and properties of fuzzy sets.
4	Basic operations on fuzzy sets.
5	T-norm and t-conorm. Aggregation operators.
6	Fuzzy relations. Extension theorem. Elements and operation of inference systems.
7	Mamdani and Sugeno (Takagi-Sugeno, Takagi-Sugeno-Kang) type inference.
8	Rector's break
9	Student presentations
10	Development of an inference system in a Matlab environment.
11	Creation and comparison of fuzzy-based empirical models.
12	Model-based fuzzy control.
13	Midterm exam
14	Make-up exam

Mid-semester requirements

Test		Assignment to be submitted		Lab measurement	
amount	week	amount	deadlines	amount	dates
1	13	1	week 9		

According to the Study and Examination regulations of Óbuda University attendance of group seminars and lab exercises are mandatory.

Other requirements for participation in sessions not covered by the regulations and restrictions on substitutions:

Test		Presentation - Assignment to be submitted		Lab measurement	
maximum points available	minimum score required to pass /test	maximum points available	minimum score required to pass / assignment	maximum points available	minimum score required to pass /lab
40 points	16 points	30 points	12 points	…points	…points

Total number of points achievable in semester:	100 points			
Grading thresholds	**satisfactory** 40 % and above	**average** 55 % and above	**good** 70 % and above	**excellent** 85 % and above

Other evaluation criteria:
Each student must deliver a presentation during Week 9 on an assigned topic. This presentation accounts for 30% of the final grade (30 points total) and is passed with a minimum score of 12 points.

A compulsory midterm quiz (written format) contributes 40% to the final grade (40 points total) and requires at least 16 points to pass.

Either assessment may be retaken during the final week's class if the student attended the original but failed, or was absent with a valid medical certificate.

The course signature is granted upon successfully completing both the presentation and midterm quiz.

Students eligible for a retake who fail it and receive a signature denial may attempt a second retake in the first two weeks of the exam period.

The final exam accounts for the remaining 30% of the grade.

Receive a signature denied entry:	The signature is denied to students who fail to meet the minimum requirements (12/30 points on the presentation or 16/40 on the midterm quiz) after exhausting the retake opportunity.
Required references:	Moodle materials, Matlab's Fuzzy Logic Toolbox https://www.mathworks.com/help/fuzzy
Recommended references:	Béla Lantos, Fuzzy Systems and Genetic Algorithms, https://vik.wiki/images/5/57/Lagyszamitas_jegyzet_2011_fuzzy_lantos.pdf
Quality assurance methods of the subject:	

Things, that are not included, can be found within the regulations of Óbuda University.