SYLLABUS

1. Data about the program of study

1.1	Institution	Technical University of Cluj-Napoca
1.2	Faculty	Faculty of Electrical Engineering
1.3	Department	Power Systems and Management
1.4	Field of study	Energy Engineering
1.5	Cycle of study	Master of Science
1.6	Program of study/ Qualification	Modern Power Systems - Cluj-Napoca in English language
1.7	Form of education	Full time

2. Data about the subject

2.1	Subject name			Applications of AI in energy engineering (project)	Course code	12
2.2	Course responsible/ lecturer			Assoc. Prof. Eng. Anca Miron, PhD.		
2.3	Teachers in charge of Seminars/ Laboratory/ Project			Assoc. Prof. Eng. Anca Miron, PhD.		
2.4 Year of study	I	2.5 Semester	2	2.6 Type of assessment *(E – exam, C – colloquium, V – verification)*	C	
2.7 Subject category	*DF – fundamental, DD – in the field, DS – specialty, DC – complementary*				DA	
	DI – compulsory, DO – elective, Dfac – optional				DI	

3. Estimated total time

3.1 Number of hours per week:	1	of which	3.2 Course	0	3.3 Seminar	0	3.3 Laboratory	0	3.3 Project	1
3.2 Total hours per semester	14	of which	3.5 Course	0	3.6 Seminar	0	3.6 Laboratory	0	3.6 Project	14

3.7 Individual study:	
(a) Manual, lecture material and notes, bibliography	13
(b) Supplementary study in the library, online and in the field	7
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	6
(d) Tutoring	3
(e) Exams and tests	1
(f) Other activities	6

3.8 Total hours of individual study *[sum (3.7(a) to 3.7(f))]*	36
3.9 Total hours per semester *[sum of 3.4 and 3.8]*	50
3.10 Number of credit points	2

4. Prerequisites (where applicable)

4.1	Curriculum	Applications of AI in energy engineering – lecturers and laboratories
4.2	Competences	Knowledge of using MATLAB

5. Requirements (where appropriate)

5.1	For the course	-
5.2	For the applications	PC network or individual device (notebook)

6. Specific competences

Professional competences	Theoretical competences: • Knowledge of basic aspects concerning artificial intelligence systems and their usage. • Mastering the operating mechanisms of fuzzy controllers. • Knowledge of the artificial neuronal network's characteristics and their functioning. • Knowledge of the way genetic algorithms operate. • Knowledge about knowledge-based systems. At the end of the oral lessons (courses) the students can: • To model / design and implement an application of AI to solve a problem found in energy systems. At the end of the course (oral and applied lessons) the students can: Use dedicated commercial software to develop algorithms based on artificial intelligence techniques that solve different energy systems issues.
Cross competences	The students can choose and use correctly the bibliographical data, regulatory normative, standards and specific methods, as well as to apply the knowledge in order to solve different problems in the field of electrical energy management using artificial intelligence techniques. The students will develop competences that help them in team working, to communicate orally and written easier, using professional and ethical values.

7. Expected learning outcomes

Knowledge	The student/graduate has very specialized knowledge of modelling, simulation and numerical analysis of power systems. The student/graduate critically understands steady-state, dynamic and transient models, as well as their application limits. The student/graduate knows modern methods used to analyze advanced energy transport systems, including direct current.
Skills	The student/graduate develops models and simulation scenarios for complex design and operation problems. The student/graduate validates numerical results, compares technological variants and critically interprets the performance of the obtained solutions. The student/graduate develops computational procedures and analytical prototypes for the investigation of new engineering and research problems.
Responsibility and autonomy	The student/graduate autonomously selects the methods, hypotheses and analysis tools appropriate to the investigated context. The student/graduate assumes responsibility for the accuracy of the models and for the quality of the technical argumentation. The student/graduate can coordinate complex analytical activities and critically review the results obtained in the team.

8. Discipline objectives (based on specific competencies acquired)

7.1	General objective	Development of artificial intelligence systems dedicated to solving energy systems issues.

7.2	Specific objectives	Physical implementation of • Fuzzy controllers, • Artificial neuronal networks, • Genetic algorithms, • Knowledge-based systems dedicated to solving energy management issues.

9. Contents

9.1. Project		Number of hours	Teaching methods	Additional remarks
1	Project's theme (application). The general characteristics of the application	1	Exemplification and display	When realizing the project, the faculty's apparatus will be used
2	Specific characteristics of the application	1		
3	Design / modelling of the application	1		
4	Design / modelling of the application	1		
5	Design / modelling of the application	1		
6	Design / modelling of the application	1		
7	Application implementation	1		
8	Application implementation	1		
9	Application implementation	1		
10	Application implementation	1		
11	Validation of the application	1		
12	Efficiency assessment of the application	1		
13	Application testing considering various scenarios	1		
14	Project's self-evaluation.	1		

Bibliography

[1] MATLAB – Fuzzy Logic Tutorial (Fuzzy Logic Toolbox)
[2] MATLAB – Artificial Neuronal Networks Tutorial (Deep Learning Toolbox)
[3] MATLAB – Optimization Tutorial (Global Optimization Toolbox)
[4] CLIPS Manual

10. Alignment of course content with expectations of the epistemic community, professional associations, and representative employers in the field

The obtained competences will help the future employs to work proficient in the field of power and energy systems efficiency.	

11. Assessment

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade (%)
10.4 Project	Developed application testing	Aral examination, 1 hour	100 %
10.6 Minimum standard of performance: Design / modelling of the application			

Date of completion	Lecturers	Title/ Surname/ Name:	Signature
September 2025	Applications Project	Assoc. Prof. Eng. Anca Miron, PhD.	

Endorsement of the Director of the department coordinating the course, only if this differs from the department organizing the study program.	**Head of Department Power Engineering and Management** Assoc. Prof. Eng. Horia G. BELEIU, PhD

Date of approval in the council of the Department of Power Engineering and Management September 2025	**Head of Department Power Engineering and Management** Assoc. Prof. Eng. Horia G. BELEIU, PhD
Date of approval in the Faculty of Electrical Engineering Council September 2025	**Dean:** Assoc. Prof. Eng. Andrei C. CZIKER, PhD