syllabus

1. Information regarding the programme

1.1 Higher education institution	**Babeş Bolyai University**
1.2 Faculty	**Faculty of Mathematics and Computer Science**
1.3 Department	**Department of Computer Science**
1.4 Field of study	**Computer Science**
1.5 Study cycle	**Bachelor**
1.6 Study programme / Qualification	**Computer Science**

2. Information regarding the discipline

2.1 Name of the discipline (en) (ro)	**Artificial Intelligence**							
2.2 Course coordinator	**Lecturer PhD Mihoc Tudor Dan**							
2.3 Seminar coordinator	**Lecturer PhD Mihoc Tudor Dan**							
2.4. Year of study	**2**	2.5 Semester	**4**	2.6. Type of evaluation	**E**	2.7 Type of discipline		
2.8 Code of the discipline	**MLE5029**							

3. Total estimated time (hours/semester of didactic activities)

3.1 Hours per week	**4**	Of which: 3.2 course	**2**	3.3 seminar/laboratory	**2 lab**
3.4 Total hours in the curriculum	**56**	Of which: 3.5 course	**28**	3.6 seminar/laboratory	**28**
Time allotment:					hours
Learning using manual, course support, bibliography, course notes					28
Additional documentation (in libraries, on electronic platforms, field documentation)					14
Preparation for seminars/labs, homework, papers, portfolios and essays					28
Tutorship					7
Evaluations					20
Other activities:					
3.7 Total individual study hours	70				
3.8 Total hours per semester	153				
3.9 Number of ECTS credits	6				

4. Prerequisites (if necessary)

4.1. curriculum	·	Graph Theory, Data Structures and Algorithms
4.2. competencies	·	Average programming skills in a high level programming language

5. Conditions (if necessary)

5.1. for the course	projector
5.2. for the seminar /lab activities	Laboratory with computers; high level programming language environment

6. Specific competencies acquired

Professional competencies	**CE1.1 Describing the concepts and the research directions in Artificial Intelligence** **CE1.2 Asses the quality and the stability of the obtained solutions and comparing them with solutions obtained by traditional methods** **CE1.3 Using the methods, techniques and algorithms from AI in order to model several classes of problems** **CE1.4 Identify and explain specific AI techniques and algorithms and using them to solve specific problems** **CE1.5 Integrating the models and the specific solutions from AI in dedicated applications**
Transversal competencies	**CT1 Applying the rules for organised and efficient work, promoting a responsible attitude towards the educational-scientific domain, in order to use fully the creative potential, respecting the principles and the norms of professional etiquette.** **CT3 Using efficient learning methods and techniques for learning, documenting, searching and developing the capacity of use the knowledge, to adapt to the requests of a dynamic society, and to properly communicate in Romanian and another international language.**

7. Objectives of the discipline (outcome of the acquired competencies)

7.1 General objective of the discipline	Ability to understand and use the basic AI algorithms and principles. Ability to model real life problems as AI problems and find optimal solutions to them
7.2 Specific objective of the discipline	Acquire the knowledge about the main classes of soft computing algorithms, the basic notions of game theory and knowledge base reasoning.

8. Content

8.1 Course	Teaching methods	Remarks
1. **Introduction to AI**	Exposure: description, explanation, examples,	

	discussion of case studies	
2. **Problem solving as search** (Problem spaces, Uninformed search, Breadth first search, Depth first search, Limited depth first search, Iterative deepening search, Uniform cost search)	Exposure: description, explanation, examples, discussion of case studies	
3. **Problem solving as search** (Informed search, Heuristic search, Best-first search, Greedy, A* algorithm, A* variants)	Exposure: descriptio n, explanatio n, debate, dialogue	
4. **Local search** (Simulated annealing, Hill climbing)	Exposure: description, explanation, examples, discussion of case studies	
5. **Evolutionary computation** (Evolutionary algorithms)	Exposure: description, explanation, examples, discussion of case studies	
6. **Swarm intelligence** (Particle swarm optimization, Ant Colonies optimization)	Exposure: description, explanation, examples, live demo	
7. **Game playing** (Minimax search, Alpha-beta pruning)	Exposure: description, explanation, examples, proofs	
8. **Knowledge representation and reasoning** (Knowledge based systems)	Exposure: description, explanation, examples, proofs, dialogues, debates	
9. **Rule based systems** (Uncertainty management in rule based systems)	Exposure: description, explanation, examples, discussion of case studies	
10. **Machine learning. Decision Trees**	Exposure: description, explanation, examples,	

	discussion of case studies	
11. **Neural networks** (Single layer neural networks, Perceptron model)	Exposure: description, explanation, examples, discussion of case studies	
12. **Neural networks** (Multi layer neural networks, Backpropagation learning)	Exposure: description, explanation, examples, discussion of case studies	
13. **Evolutionary Computation** (Evolutionary strategies, Evolutionary programming, Genetic programming)	Exposure: description, explanation, examples, discussion of case studies	
14. **Intelligent Systems** (Support Vector Machines, K mean)	Exposure: description, explanation, examples, discussion of case studies	

Bibliography

GROSAN, C., Abraham, A., Intelligent Systems: a modern approach, Springer Verlag GERMANY, 2011

PATRIDGE, D., Artificial Intelligence. Applications in the future of software engineering, Ellis Harwood Series in A.I., John Wiley & Sons, New York 1986.

RICH, E. Artificial Intelligence, Mc.Graw Hill, 1989.

WINSTON, P., Inteligenta artificiala, Ed.Tehnica, 1980.

GOLDBERG, D. E., Genetic Algorithm. AddisonWesley, Reading, 1989

8.2 Laboratory	Teaching methods	Remarks
1. Task: Implement an uninformed search algorithm, given from a list of projects	case studies, dialogues	
2. Task: Implement an informed search algorithm, given from a list of projects	case studies, dialogues	
3. Task:Implement an Evolutionary Algorithm, given from a list of projects	case studies, dialogues	
4. Task: Implement a PSO algorithm, given from a list of projects	case studies, dialogues	
5. Task:Implement an ACO algorithm, given from a list of projects	case studies, dialogues	
6. Task: solve (implement and test) a game, given from a list of projects	case studies, dialogues	
7. Task: implement a rule based system, and apply it on a specific problem	case studies, dialogues	

8. Task: Implement a simple perceptron and train it.	case studies, dialogues	
9. Task: implement a Neural Network, and apply it on a specific problem	case studies, dialogues	
10. Task: add to the previous implementations specific deep learning layers in order to solve a simple image classification problem	case studies, dialogues	
11. Task: Implement a GP algorithm, and apply it on a specific problem	case studies, dialogues	
12. Task: Implement a clustering algorithm, and apply it on a specific problem	case studies, dialogues	
13. Task: Solve a complex regression problem	case studies, dialogues	
14. Task: Solve a complex classification problem	case studies, dialogues	

Bibliography:

1. GROSAN, C., Abraham, A., Intelligent Systems: a modern approach, Springer Verlag GERMANY, 2011
2. RUSSELL, S., J., NORVIG, P., Artificial intelligence: A modern approach, N.J. Prentice Hall/Pearson Education, 2003

9. Corroborating the content of the discipline with the expectations of the epistemic community, professional associations and representative employers within the field of the program

The course follows the scheme and structure used by the most important universities in USA and Europe;
The course exists in the studying program of all major universities in Romania and abroad.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	know the basic principle of the AI domain; apply the course concepts problem solving	Written exam (there will be two written exams)	60%
10.5 Seminar/lab activities	- be able to implement the algorithms described in the course and discussed at the	Lab assignments	40%

	demonstrations during the laboratories		

10.6 Minimum performance standards

At least grade 5 (from a scale of 1 to 10) at both written exams and laboratory work

Date	Signature of course coordinator Lecturer Phd. Tudor Dan Mihoc	Signature of seminar coordinator Lecturer Phd. Tudor Dan Mihoc

Date of approval

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Signature of the head of department

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