SYLLABUS

1. Information regarding the programme

1.1 Higher education institution	**Babes Bolyai University**
1.2 Faculty	**Faculty of Mathematics and Computer Science**
1.3 Department	**Informatics**
1.4 Field of study	**Informatics**
1.5 Study cycle	**Master**
1.6 Study programme / Qualification	**Inteligență Computațională Aplicată**

2. Information regarding the discipline

2.1 Name of the discipline (en) (ro)			**Computational Meta and Hyper Heuristics** **Meta-euristici şi hiper-euristici computaţionale**				
2.2 Course coordinator			**Prof. Univ. Dr. D. Dumitrescu**				
2.3 Seminar coordinator			**Prof. Univ. Dr. D. Dumitrescu**				
2.4. Year of study	**1**	2.5 Semester	**1**	2.6. Type of evaluation	**E**	2.7 Type of discipline	**DF**
2.8 Code of the discipline	MME8089						

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
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	7

4. Prerequisites (if necessary)

4.1. curriculum	• Graph Theory, Data Structures and Algorithms, Basic knowledge of AI methods and techniques
4.2. competencies	• Medium proficiency in an advanced programming language (object oriented)

5. Conditions (if necessary)

5.1. for the course	•
5.2. for the seminar /lab activities	•

6. Specific competencies acquired

Professional competencies	**● An introduction to automatic parameter settings for different AI techniques.** **● Acquire the basic notion, techniques and methods for selecting and combining heuristics for AI techniques.**
Transversal competencies	**● Ability to apply high level AI techniques to different real life problems** **● Ability to model problems in an interdisciplinary field**

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

7.1 General objective of the discipline	• Ability to understand and use the basic heuristic selection in AI algorithms. • Ability to model real life problems as AI problems and find optimal hyper - heuristics in order to determine solutions for them.
7.2 Specific objective of the discipline	• Acquire advance knowledge about the main classes of soft computing algorithms and knowledge base reasoning.

8. Content

8.1 Course	Teaching methods	Remarks
1. Introduction	Exposure: description, explanation, examples, discussion of case studies	
2. Evolutionary Algorithms	Exposure: description, explanation, examples, discussion of case studies	
3. Genetic Algorithms	Exposure: description, explanation, examples, discussion of case studies	
4. Evolution strategies	Exposure: description, explanation, examples, discussion of case studies	
5. Evolutionary programming	Exposure: description, explanation, examples, discussion of case studies	
6. Genetic programming	Exposure: description, explanation, examples, discussion of case studies	
7. Parameter testing/control genetic walkers	Exposure: description, explanation, examples, discussion of case studies	

8. Memetic algorithms	Exposure: description, explanation, examples, discussion of case studies	
9. Other bio – inspired methods	Exposure: description, explanation, examples, discussion of case studies	
10. Meta - heuristics	Exposure: description, explanation, examples, discussion of case studies	
11. Automatic parameter settings	Exposure: description, explanation, examples, discussion of case studies	
12. Hyper - heuristics	Exposure: description, explanation, examples, discussion of case studies	
13. Dynamic optimisation	Exposure: description, explanation, examples, discussion of case studies	
14. Game theory and EC	Exposure: description, explanation, examples, discussion of case studies	

Bibliography

1. GROSAN, C., Abraham, A., *Intelligent Systems: a modern approach*, Springer Verlag GERMANY, 2011.
2. PATRIDGE, D., *Artificial Intelligence. Applications in the future of software engineering*, Ellis Harwood Series in A.I., John Wiley & Sons, New York 1986.
3. RICH, E. *Artificial Intelligence*, Mc.Graw Hill, 1989.
4. WINSTON, P., *Inteligenta artificiala*, Ed.Tehnica, 1980. GOLDBERG, D. E., Genetic Algorithm. AddisonWesley, Reading, 1989.
5. Dumitrescu, D., et al., *Evolutionary computation,* CRC press, 2000.

8.2 Seminar / laboratory	Teaching methods	Remarks
1. Optimization - large scale	Explanation, dialogue, case studies, problem solving	The laboratory is structured as 2 hours classes every second week
2. Multi-objective optimization	Explanation, dialogue, case studies, problem solving	
3. Multimodal optimization	Explanation, dialogue, case studies, problem solving	
4. Dynamic optimization	Explanation, dialogue, case studies, problem solving	
5. Combinatorial optimization	Explanation, dialogue, case studies, problem solving	
6. Complex networks	Explanation, dialogue, case studies, problem solving	
7. Game theory. Evolutionary art	Explanation, dialogue, case studies, problem solving	

Bibliography

1. GROSAN, C., Abraham, A., *Intelligent Systems: a modern approach*, Springer Verlag GERMANY, 2011.
2. PATRIDGE, D., *Artificial Intelligence. Applications in the future of software engineering*, Ellis Harwood Series in A.I., John Wiley & Sons, New York 1986.
3. RICH, E. *Artificial Intelligence*, Mc.Graw Hill, 1989.
4. WINSTON, P., *Inteligenta artificiala*, Ed.Tehnica, 1980. GOLDBERG, D. E., Genetic Algorithm. AddisonWesley, Reading, 1989.
5. Dumitrescu, D., et al., *Evolutionary computation,* CRC press, 2000.

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

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 principles; apply the course concepts; problem solving	Written exam (there will be two written exams)	60,00%
10.5 Seminar/lab activities	Be able to implement the algorithms described in the course and discussed during the seminars	- individual projects	40,00%
10.6 Minimum performance standards			
➢ At least grade 5 (from a scale of 1 to 10) at both written exams and project work			

Date	Signature of course coordinator	Signature of seminar coordinator
.....	Prof. D. Dumitrescu	Prof. D. Dumitrescu

Date of approval ..... Signature of the head of department .....