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	**Master**
1.6 Study programme / Qualification	**Computer Science**

2. Information regarding the discipline

2.1 Name of the discipline			**Advanced Evolutionary Computing in Solving Complex Problems**				
2.2 Course coordinator			**Prof.PhD. Dumitru Dumitrescu**				
2.3 Seminar coordinator			**Prof.PhD. Dumitru Dumitrescu**				
2.4. Year of study	**1**	2.5 Semester	**2**	2.6. Type of evaluation	**E**	2.7 Type of discipline	**Compulsory**

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

3.1 Hours per week	3	Of which: 3.2 course	2	3.3 seminar/laboratory	1 sem
3.4 Total hours in the curriculum	42	Of which: 3.5 course	28	3.6 seminar/laboratory	14

Time allotment:	hours
Learning using manual, course support, bibliography, course notes	20
Additional documentation (in libraries, on electronic platforms, field documentation)	10
Preparation for seminars/labs, homework, papers, portfolios and essays	23
Tutorship	7
Evaluations	20
Other activities:	-

3.7 Total individual study hours	80
3.8 Total hours per semester	150
3.9 Number of ECTS credits	6

4. Prerequisites (if necessary)

4.1. curriculum	
4.2. competencies	Average programming skills

5. Conditions (if necessary)

5.1. for the course	

6. Specific competencies acquired

Professional competencies	Knowledge, understanding and use of basic concepts of EMCO
Transversal competencies	Ability to apply multicriteria optimization problems to different real life problems Ability to model phenomena using multicriteria optimization problem

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

7.1 General objective of the discipline	complex problems; skills for addressing complex real-world problems; the background for advanced studies and research in the field;
7.2 Specific objective of the discipline	

8. Content

8.1 Course	Teaching methods	Remarks
1. Introduction to Numerical optimization.	Exposure: description, explanation, examples, discussion of case studies	
2. Evolutionary numerical optimization. Problem representation. Fitness assignment.	Exposure: description, explanation, examples, discussion of case studies	
3. Evolutionary dynamical optimization. Noisy fitness function. Dynamic environments. Dynamic fitness function (moving peaks benchmark).	Exposure: description, explanation, examples, debate, dialogue	
4. Evolutionary dynamical optimization. Generating diversity. Memory based approaches. Multipopulation approaches. Hybrid approaches.	Exposure: description, explanation, examples, discussion of case studies	
5. Evolutionary multicriteria optimization (EMOO). Basic concepts.	Exposure: description, explanation, examples, proofs	
6. EMOO – Standard techniques (VEGA, MOGA, NPGA, PESA)	Exposure: description, explanation, examples, proofs, debate, dialogue	
7. EMOO – SPEA, SPEA2 algorithms	Exposure: description, explanation, examples,	

	discussion of case studies	
8. EMOO – NSGA, NSGA-II techniques	Exposure: description, explanation, examples	
9. EMOO – GHEA, Roaming, PSO and DE approaches	Exposure: description, explanation, examples, discussion of case studies	
10. EMOO – performance measures	Exposure: description, explanation, examples, debate	
11. Combinatorial optimization – problem statement and basic approaches	Exposure: description, explanation, examples, discussion of case studies	
12. NP-complete problems and metaheuristics	Exposure: description, explanation, examples, discussion of case studies	
13. Evolutionary approaches for addressing NP-hard problems.	Exposure: description, explanation, examples, discussion of case studies	
14. Evolutionary network optimization – Network models. Dynamical network optimization/search.	Exposure: description, examples, discussion of case studies, live demo	

Bibliography

DUMITRESCU,D.,B Lazzerini,Evolutionary Computation, CRC Press, New York, Boca Raton, 2000

DUMITRESCU,D.,B Lazzerini,Fuzzy Sets and treir Application in Training and Clustering , CRC Press, New York, Boca Raton, 2000

DUMITRESCU, D.,Principiile Inteligentei artificiale, Editura Albastra, Cluj,2000.

DUMITRESCU, D.,Principiile teoriei clasificarii, Editura Academiei, Bucuresti,2000.

DUMITRESCU, D.,Algoritmi genetici si strategii evolutive. Aplicatii in Inteligenta Artificiala, Editura Albastra, Cluj,2000.

DUMITRESCU, D., Inteligenta artificiala, Univ. "Babes-Bolyai", 1995.

GOLDBERG, D. E., Genetic Algorithm. Addison-Wesley, Reading, 1989.

MICHALEWICZ, Z., Genetic Algorithms + Data Structures = Evolution Programs, Springer, Berlin, 1992.

8.2 Seminar	Teaching methods	Remarks
1. Evolutionary numerical optimization. Problem representation. Fitness assignment. - problems	Explation, dialogue, case studies	The seminar is structured as 2 hours classes every second week
2. Evolutionary dynamical optimization. Generating diversity. Memory based approaches. Multipopulation approaches. Hybrid approaches. - problems	Dialogue, debate, case studies, examples, proofs	
3. Evolutionary multicriteria optimization (EMOO). Basic concepts. -problems	Dialogue, debate, case studies, examples, proofs	
4. EMOO standard techniques - problems	Dialogue, debate, case studies, examples	
5. Combinatorial optimization – problem statement	Dialogue, debate, case	

and basic approaches -problems	studies, examples	
6. Evolutionary approaches for addressing NP-hard problems. -problems	Dialogue, debate, case studies, examples	
7. Evolutionary network optimization – Network models. Dynamical network optimization/search. -problems	Dialogue, debate, case studies, examples	

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DUMITRESCU,D.,B Lazzerini,Evolutionary Computation, CRC Press, New York, Boca Raton, 2000

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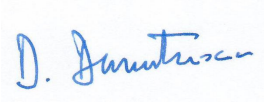
9. Corroborating the content of the discipline with the expectations of the epistemic community, professional associations and representative employers within the field of the program

- The course exists in the studying program of all major universities in Romania and abroad;
- The content of the course is considered important in the MCO state of the art.

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 domain; - apply the course concepts - problem solving	Written exam	50%
10.5 Seminar/lab activities	- be able to implement course concepts and algorithms - be able to make a practical project during the semester	-Practical project -documentation -portofolio -continous observations	50%
10.6 Minimum performance standards			
➢ At least grade 5 (from a scale of 1 to 10) at both written exam and laboratory work.			

Date Signature of course coordinator Signature of seminar coordinator



Prof.PhD. Dumitru Dumitrescu

Date of approval	Signature of the head of department
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