COURSE SHEET

Optimization techniques Academic year 2022-2023

	1. About the program	•
1.1	University	Universitatea din Piteşti
1.2	Faculty	Sciences, Physical Education and Computer Science
1.3	Department	Mathematics-Computer Science
1.4	Field of study	Informatics
1.5	Cycle of studies	Master
1.6	Study Program / Qualification	Advanced techniques for information processing/ Advanced techniques for
		information processing

2. Discipline data

2.1	.1 Name of the discipline					Opti	mization technique	s			
2.2	.2 The holder of the course activities										
2.3	Holder of laboratory activities										
2.4	Year of study	Ι	2.5	Semester	1	2.6	Type of assessment	С	2.7	Discipline regimen	A

3. Estimated total time

3.1	Number of hours per week	2	3.2	of which course	1	3.3	laboratory	1
3.4	Total hours of the curriculum	28	3.5	of which course	14	3.6	laboratory	14
Distr	bution of the time fund							hours
Stud	y by textbook, course support, biblic	ography a	ind note	s				28
Addit	ional documentation in the library, c	on specia	lized el	ectronic platforms a	nd in th	e field		28
Preparation of seminars/ laboratories, themes, papers, portfolios, essays								25
Tutoring							14	
Examination								2
Other activities							-	
3.7	Total hours of self-study		ç)7				
38	Total hours per semester		1	25				

nours pe 3.9 Number of credits

4. Preconditions (where applicable)

4.1	Curriculum	Notions of mathematical analysis, Algorithms and Data Structures, Programming
4.2	Skills	Ability to think logically, to analyze, to synthesize, to program

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5. Conditions (where applicable)

5.1	Conduct of the course	Room with blackboard/whiteboard and video projector						
52	Conducting the seminar/laboratory		with	blackboard/whiteboard,	video	projector	and	
5.2	Conducting the seminarhaboratory	compu	ter equ	ipment				

6. Acquired specific skills

Professional skills	 Operating with advanced notions, methods and techniques of optimization. Mathematical modeling (Solving real/concrete problems with the help of the mathematical tools). Use of specialized software/software packages. Designing, organizing and carrying out teaching-learning and assessment activities in mathematics. Operating with basic concepts of psycho-pedagogical disciplines. Operating with basic concepts of psycho-pedagogical disciplines.
Transversal competences	 Applying the rules of organized and efficient work, of responsible attitudes towards the scientific-professional field, for the creative capitalization of one's own potential, respecting the principles and norms of professional ethics; Efficiently carrying out the activities organized in an interdisciplinary team by assuming execution and leadership functions, with the development of empathic capacities of inter-personal communication, networking and collaboration with various groups; Elaboration of own professional development project; the use of effective methods and techniques for learning, information, research and capacity development, for valuing knowledge, for adapting to the requirements of a dynamic society and for communicating in Romanian and English.

7. The objectives of the discipline

7.1 The general objective of the discipline	The general objective of the discipline is the acquisition by students of the basic knowledge and methods regarding the optimization techniques, of the modalities of implementation and adequate application to concrete situations of these methods and techniques.
7.2 Specific objectives	<u>A. Cognitive objectives</u> <u>1. Knowledge and understanding of basic knowledge of optimization techniques.</u> <u>2. Operating with the concepts and penetrating the meaning of the fundamental principles of optimization techniques.</u> <u>3. Understanding the basic concepts of the discipline and mastering the methods of approach.</u> <u>4. Recognition formulation and algorithmic treatment of optimization techniques.</u> selection and
	proper application of tools needed to solve problems.

B. Procedural objectives
1. Applying evaluation principles and methods to solve well-defined problems / situations.
2. Identifying concrete situations for the application of mathematical methods, which allow the
student to analyze promptly and to make synthetic and correct decisions regarding the evaluation of
the different patrimonial elements of the enterprise or of the entity as a whole.
3. Elaboration of professional reports / homework with the use of notions, principles, established
methods in the field of optimization techniques and their applications.
C. Attitudinal goals
1 Respecting the norms of professional ethics and deontology specific to mathematicians and
computer scientists
2 Familiarization with specific roles in a team's network and cooperation in specific activities or
teamwork to solve various homework and assignments
2. Using apositio methods to develop a personal and preferenced development plan, along with
5. Using specific methods to develop a personal and professional development plan, along with
awareness of the need for continuing education.

8. Contents

8.1. Co	ourse	Nr. hours	Teaching methods	Observations Resources used				
1,,7	 Convex and concave functions. (2 hours) Maximum and minimum functions. (2 hours) Notions of optimization theory: unrestricted optimization and restricted optimization. (2 hours) Linear, quadratic and integer programming. (2 hours) Gradient methods. Searching methods of Newton type for optimum points. (2 hours) Optimal point search methods for functions wirh one variable: half-range method, Fibonacci method, gold section method, interpolation methods. (2 hours) Meta-heuristic algorithms for searching the optimal points, Simulated Hardening algorithms, genetic algorithms. (2 hours) 	14	Explanation Description and exemplification Proof Problematization Heuristic Conversation Exercise	Blackboard/ whiteboard computer projector				
Bibliog	graphy							
1. 2. 3. 4. 5. 6. 7. 8.	 Mark French, Fundamentals of Optimization. Methods, Minimum Principles, and Applications for Making Things Better, Springer, 2018. Mykel J. Kochenderfer and Tim A. Wheeler, Algorithms for Optimization, MIT Press, 2019. Slawomir Koziel, Xin-She Yang (Eds.), Computational, Optimization, Methods and Algorithms, Springer, 2011. Sukanta Nayak, Fundamentals of Optimization Techniques with Algorithms, Elsevier, 2020. P.C. Pop, Cercetări Operaționale, Editura Risoprint, Cluj-Napoca, 2007. P.C. Pop, The generalized Minimum Spanning Tree Problem, Twente University Press, the Netherlands, 2008 Wenyu Sun, Ya-Xiang Yuan, Optimization theory and methods. Nonlinear programming, Springer, 2006. 							
8.2. Aj	pplications – Seminar / Laboratory	Nr. hour	s Teaching methods	Observations Resources used				
1,,7	 Convex and concave functions. (2 hours) Maximum and minimum functions. (2 hours) Notions of optimization theory: unrestricted optimization and restricted optimization. (2 hours) Linear, quadratic and integer programming. (2 hours) Gradient methods. Searching methods of Newton type for optimum points. (2 hours) Optimal point search methods for functions wirh one variable: half-range method, Fibonacci method, gold section method, interpolation methods. (2 hours) Meta-heuristic algorithms for searching the optimal points, Simulated Hardening algorithms, genetic algorithms. (2 hours) 	14	Explanation Description and exemplification Case study Exercise Problematization Individual themes Group work Debate	Blackboard/ whiteboard computer projector				
Bibli	iography , , , , , , , , , , , , , , , , , , ,	•	·					
1. 2. 3. 4. 5. 6. 7. 8.	 Bibliography Mark French, Fundamentals of Optimization. Methods, Minimum Principles, and Applications for Making Things Better, Springer, 2018. Mykel J. Kochenderfer and Tim A. Wheeler, Algorithms for Optimization, MIT Press, 2019. Slawomir Koziel, Xin-She Yang (Eds.), Computational, Optimization, Methods and Algorithms, Springer, 2011. Sukanta Nayak, Fundamentals of Optimization Techniques with Algorithms, Elsevier, 2020. P.C. Pop, Cercetări Operaționale, Editura Risoprint, Cluj-Napoca, 2007. P.C. Pop, The generalized Minimum Spanning Tree Problem, Twente University Press, the Netherlands, 2008. Wenyu Sun, Ya-Xiang Yuan, Optimization theory and methods. Nonlinear programming, Springer, 2006. R. Trandafir, Modele și algoritmi de optimizare, Editura AGIR, București, 2006. 							

The competences acquired within the discipline allow the graduates to efficiently use the optimization techniques, in solving the requirements related to the practice and research in the field of informatics. The contents are correlated with

those of similar disciplines in prestigious universities in the country and abroad and adjusted after discussions with representatives of local IT employers (such as RoWeb, Lisa, Prodinf, Kepler, Osf, Endava).

10. Evaluation

Activity Type		10.1 Assessment criteria	10.2 Assessment methods	10.3 Percent of final grade
10.4 Course	 Correctness General und disciplin fundame Logical cohe The degree of 	of assimilated notions erstanding of the importance of the studied e and the connection with the other ental disciplines rence of assimilation of the specialized language	Final written assessment	30%
 Ability to Ability to Ability to Ability to Criteria 		perate with abstract knowledge pply in practice regarding attitudinal aspects: interest in	Homework	20%
	individual st	udy and seriousness in dealing with problems	Project	50%
10.6 Minimum performance standard		 * Marks of at least 5 for the laboratory activity requirements); final grade at least 5. * Set of minimal knowledge for passing the final - Knowledge of the main computational mode Knowledge of ways of adequate application an proposed problems. 	r, for the project and for the final eva al exam: els studied; d efficient implementation of these	duation (50% solving the models in solving the
Date of completion 22.09.2022		Course holder Prof.univ.dr.habil. Loredana BĂLILE	Laboratory I SCU Prof.univ.dr.habil. Lo Am	nolder predana BĂLILESCU

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Date of approval in the DepartmentDirector Department (provider)22.09.2022Conf.univ.dr. Doru CONSTANTIN

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Director Department (*beneficiary*)) Conf.univ.dr. Doru CONSTANTIN