SUBJECT TEACHING GUIDE

366 - Heuristic and Metaheuristic Techniques

Master's Degree in Mathematics and Computing

Academic year 2026 - 2027

1. IDENTIFYING DATA					
Degree	Master's Degree in Mathematics and Computing			Type and Year	Optional. Year 1
Faculty	Faculty of Sciences				
Discipline					
Course unit title and code	366 - Heuristic and Metaheuristic Techniques				
Number of ECTS credits allocated	3	Term		Semester based (2)	
Web					
Language of instruction	Spanish	English Friendly	No	Mode of delivery	Face-to-face

Department	DPTO. MATEMATICAS, ESTADISTICA Y COMPUTACION
Name of lecturer	PABLO GARCIA GOMEZ
E-mail	pablo.garciagomez@unican.es
Office	Facultad de Ciencias. Planta: + 0. DESPACHO DE PROFESORES (0058)
Other lecturers	ANDRES IGLESIAS PRIETO AKEMI GALVEZ TOMIDA

3.1 LEARNING OUTCOMES
Learn, understand and know how to apply different heuristic and metaheuristic techniques to solving complex problems, mainly in the scope of Artificial Intelligence.

4. OBJECTIVES
Identify problems for which, because of their complexity, it is appropriate to use metaheuristic techniques, and be familiar with real-world examples where they have been successfully applied.
Understand and know how to apply population-based methods: genetic algorithms, evolutionary strategies, memetic algorithms, genetic programming, swarm methods.
Know and be able to apply constructive metaheuristics: ant colony optimization.
Know and be able to apply population-based methods: genetic algorithms, evolutionary strategies, memetic algorithms, genetic programming, swarm algorithms.

Introduce metaheuristic techniques for multi-objective optimization.

6. COURSE ORGANIZATION	
CONTENTS	
1	Introduction: basic concepts and taxonomy of heuristic and metaheuristic methods.
4	Trajectory and neighborhood metaheuristics: basic local search, simulated annealing, variable neighborhood search, and tabu search.
5	Population-based metaheuristics: genetic algorithms, evolution strategies, memetic algorithms, genetic programming, swarm methods.
3	Constructive metaheuristics: ant colony optimization
7	Multiobjective optimisation.
2	Exact methods: uninformed search, informed search and their limitations
6	Hybrid metaheuristics

7. ASSESSMENT METHODS AND CRITERIA				
Description	Type	Final Eval.	Reassessment	%
Final proyect.	Work	No	Yes	100,00
TOTAL				100,00
Observations				
The assignment may (optionally) be written in English. The topic and nature of the written assignment will be decided depending on the student's interests and may be proposed by the student, subject to the lecturers' approval.				
Observations for part-time students				
Part-time students will be assessed in the same way as full-time students.				

8. BIBLIOGRAPHY AND TEACHING MATERIALS
BASIC
M. Gendreau, J-Y. Potvin (eds), "Handbook of Metaheuristics", Springer, 2nd Ed. (2010)
E-G. Talbi, "Metaheuristics. From design to implementation", John Wiley & Sons (2009)