

SUBJECT TEACHING GUIDE

G2079 - Discrete Mathematics

Degree in Mathematics

Academic year 2024-2025

1. IDENTIFYING DATA					
Degree	Degree in Mathematics			Type and Year	Core. Year 1
Faculty	Faculty of Sciences				
Discipline					
Course unit title and code	G2079 - Discrete Mathematics				
Number of ECTS credits allocated	6	Term	Semester based (2)		
Knowledge Field					
Web					
Language of instruction	Spanish	English Friendly	No	Mode of delivery	Face-to-face

Department	DPTO. MATEMATICAS, ESTADISTICA Y COMPUTACION				
Name of lecturer	MONICA BLANCO GOMEZ				
E-mail	monica.blancogomez@unican.es				
Office	Facultad de Ciencias. Planta: + 0. SECRETARIA DEL DEPARTAMENTO (0050)				
Other lecturers					

4. OBJECTIVES

Discrete mathematics is an increasingly important branch of mathematics, both pure and applied. This course intends to give an overview of it focusing on two topics: graph theory, which models many networks, processes, diagrams or relations among discrete objects, and enumerative combinatorics, that is to say, techniques to count the number of elements in a finite set, and its applications.

6. SUBJECT PROGRAM	
CONTENTS	
1	<p>Combinatorics.</p> <p>Introduction to combinatorics. Factorial and binomial numbers. Binomial theorem. Inclusion-exclusion principle.</p> <p>Generating functions. Formal power series and generating functions. Homogeneous linear recurrences. Fibonacci and Catalan numbers. Partitions of a positive integer.</p>
2	<p>Graph Theory.</p> <p>Graphs. Representation of graphs. Isomorphism. Paths and cycles. Eulerian and Hamiltonian graphs.</p> <p>Trees and search algorithms. Spanning trees. Depth first search and breadth first search. Dijkstra's algorithm. Rooted trees. Binary trees.</p> <p>Bipartite graphs. Matchings, maximal and perfect matchings. Augmenting path algorithm. Hall's theorem.</p> <p>Digraphs and networks. Directed graphs. Networks. Flows and cuts. Max-flow-min-cut algorithm.</p> <p>Planar graphs. Kuratowski's Theorem. Euler's formula. Four color theorem. Graph coloring. Polyhedra and f-vectors.</p>
3	Preparation and realization of final exam.

7. ASSESSMENT METHODS AND CRITERIA				
Description	Type	Final Eval.	Reassessn	%
Final exam (60%)	Written exam	Yes	Yes	60,00
2 hour tests that can amount to 40% of the final grade	Written exam	No	Yes	40,00
TOTAL				100,00
Observations				
A minimum grade of 3/10 is required for each block of contents (Combinatorics and Graph Theory), where this grade is the maximum between 60% of the final exam and 40% of the continuous evaluation, or 100% of the final exam. The final grade will have to be a minimum of 5: 40% combinatorics, 60% graph theory (orientative percentages).				
Observations for part-time students				
Same as full-time students.				

8. BIBLIOGRAPHY AND TEACHING MATERIALS
BASIC
N. Biggs: Discrete Mathematics, Revised edition. Clarendon Press, Oxford, 1989.
R. P. Grimaldi: Discrete and combinatorial mathematics, an applied introduction. Addison-Wesley, 1989.