

SUBJECT TEACHING GUIDE

1489 - Analytical and Numerical Methods in Engineering

Master's Degree in mining engineering

Academic year 2025-2026

1. IDENTIFYING DATA					
Degree	Master's Degree in mining engineering			Type and Year	Compulsory. Year 1
Faculty	School of Mines and Energy Engineering				
Discipline					
Course unit title and code	1489 - Analytical and Numerical Methods in Engineering				
Number of ECTS credits allocated	4,5	Term	Semester based (1)		
Knowledge Field	Architecture, construction, building and urban planning, civil engineering				
Web					
Language of instruction	Spanish	English Friendly	No	Mode of delivery	Face-to-face

Department	DPTO. MATEMATICA APLICADA Y CIENCIAS DE LA COMPUTACION				
Name of lecturer	DIEGO RUIZ ANTOLIN				
E-mail	diego.ruizantolin@unican.es				
Office	E.T.S. de Ingenieros Industriales y de Telecomunicación. Planta: - 5. DESPACHO (S5016)				
Other lecturers	MARIA EUGENIA PEREZ MARTINEZ				

4. OBJECTIVES
Complement the mathematical knowledge base of graduate students on differential equations and numerical methods applied to mining and energy engineering.
Improve the interpretation of the results obtained in the context of mining and energy engineering, mechanics, mathematical engineering and the SDG 6 and 12.
Computer simulation of some processes in differential models.

6. SUBJECT PROGRAM

CONTENTS

1	Partial differential equations in engineering.
1.1	ODE: Initial value problems. Boundary value problems. Eigenvalues.
1.2	Models for the heat, wave and Laplace equations. Separation of variables. 1.2.1.-Wave and vibration problems. 1.2.2.-Mixed problems for the diffusion equation. 1.2.3.-Boundary problems for the Laplace equation.
2	Numerical methods in engineering.
2.1	Numerical evaluation of differential equations.
2.2	Systems of nonlinear equations.
2.3	Numerical optimization.
2.4	Eigenvalue computation.

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
Computer work reports	Laboratory evaluation	No	No	40,00
Homework reports	Work	No	Yes	30,00
Final exam	Laboratory evaluation	Yes	Yes	30,00
TOTAL				100,00
Observations				
All evaluation activities can be re-taken during the extraordinary evaluation date. Those students who didn't reach the minimum mark in the homework reports can hand over a new copy of them before the extraordinary evaluation date and they must be publicly presented in class.				
Observations for part-time students				
Part-time students can follow the same rules as the rest of the students, given that all materials will be available through the Moodle virtual environment, which will also be used to collect the assignments. Part-time students must attend written exams. In case that the student cannot fulfill the computer work reports, this part will be marked with the presentation of an additional homework report.				

8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC
O'Neil P.V. (1994) Matemáticas avanzadas para la Ingeniería. 3ª Edición. Cecsá
Quarteroni A., Saleri F. (2006) Calculo científico con Matlab y Octave. Springer Verlag
Haberman R. (2003) Ecuaciones en Derivadas Parciales con series de Fourier y Problemas de Contorno. 3ª Edición. Prentice Hall
Pérez M.E. (2014) Cálculo simbólico y numérico en Ecuaciones Diferenciales, OCW, Santander
Boyce W.E., Diprima R.C. (1986) Elementary Differential Equations and Boundary Value Problems. John Wiley and Sons (Cuarta o Quinta Edición, también ediciones en castellano).

