SUBJECT TEACHING GUIDE

G98 - Numerical Analysis I

Double Degree in Physics and Mathematics
Degree in Mathematics

Academic year 2023-2024

1. IDENTIFYING DATA					
Degree	Double Degree in Physics and Mathematics Degree in Mathematics			Type and Year	Compulsory. Year 3 Compulsory. Year 2
Faculty	Faculty of Sciences				
Discipline	Subject Area: Computational Mathematics Module: Compulsory Subjects				
Course unit title and code	G98 - Numerical Analysis I				
Number of ECTS credits allocated	6	Term		Semester based (2)	
Web	http://personales.unican.es/segurajj/cn1_2324.html				
Language of instruction	Spanish	English Friendly	Yes	Mode of delivery	Face-to-face

Department	DPTO. MATEMATICAS, ESTADISTICA Y COMPUTACION
Name of lecturer	JOSE JAVIER SEGURA SALA
E-mail	javier.segura@unican.es
Office	Facultad de Ciencias. Planta: + 1. DESPACHO PROFESORES (1045)
Other lecturers	

3.1 LEARNING OUTCOMES
- Understanding the intrinsic limitations of floating point arithmetic and its impact in numerical computations.
- Understanding the concepts of condition of a problem and numerical stability.
- Understanding and putting into practice methods for the numerical solution of nonlinear equations, learning the pros and cons of each method depending on the problem to be solved.
- To be able to compute polynomial approximations based on interpolation, estimating the error in some simple cases.
- Practical knowledge of several methods for numerical quadrature, and discussion of the convenience of each method depending on the integral to be computed.
- To be able to design and implement specific algorithms and to be able to diagnose and correct possible errors in a autonomous way.

4. OBJECTIVES
Applying numerical methods for solving problems such as the solution of nonlinear equations, the approximation of functions by polynomial interpolation and the computation of integrals by numerical quadrature.
Practical application of numerical techniques, designing and implementing numerical algorithms.
To understand basic concepts of numerical analysis such as: numerical stability, computational cost, order of convergence, and to be able to analyze various numerical algorithms using this concepts.

6. COURSE ORGANIZATION	
	CONTENTS
1	INTRODUCTION TO NUMERICAL ANALYSYS 1.1 Computational arithmetic. Floating point standard. 1.2 Conditioning of a problem. Stability of numerical methods. Examples. 1.3 Computational cost and efficiency. Examples.
2	NUMERICAL SOLUTION OF NONLINEAR EQUATIONS 2.1 Introduction 2.2 Bisection method. 2.3 The secant method. 2.4 The Newton-Raphson method. 2.5 Fixed point methods 2.6 Roots of polynomials
3	INTERPOLATION AND APPROXIMATION 3.1 Lagrange interpolation and Lagrange formula 3.2 Barycentric interpolation formula 3.3 Interpolation error 3.2 Lagrange Interpolation with divided differences 3.3 Hermite interpolation 3.4 Approximation in an interval. Chebyshev interpolation.
4	NUMERICAL DIFFERENTIATION AND INTEGRATION 4.1 Interpolatory integration. Simple and compound Newton-Cotes formulas. 4.2 Introduction to Gaussian quadrature 4.3 Differentiation by interpolation

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
Final exam	Written exam	Yes	Yes	60,00
Computer lab exercises	Laboratory evaluation	No	Yes	40,00
TOTAL				100,00

Observations

The score in the final exam can not be smaller than 4 in order to pass the subject.
The lab assignment scores can be kept for the extraordinary exam. This decision corresponds to the student.

Observations for part-time students

Any student in this category can choose between following the continuous evaluation examinations or being evaluated of all the contents in the final exam (which is compulsory for all students of this subject).

8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC

J. Segura, Apuntes de Cálculo Numérico I, 2021.