

## SUBJECT TEACHING GUIDE

### G114 - Numerical Analysis III

#### Double Degree in Physics and Mathematics Degree in Mathematics

Academic year 2023-2024

| 1. IDENTIFYING DATA              |   |                  |                    |                  |                                      |
|----------------------------------|---|------------------|--------------------|------------------|--------------------------------------|
| Degree                           | Double Degree in Physics and Mathematics<br>Degree in Mathematics                               |                  |                    | Type and Year    | Optional. Year 5<br>Optional. Year 4 |
| Faculty                          | Faculty of Sciences   |                  |                    |                  |                                      |
| Discipline                       | Subject Area: Further Computational Mathematics<br>Mention in Pure and Applied Mathematics      |                  |                    |                  |                                      |
| Course unit title and code       | G114 - Numerical Analysis III   |                  |                    |                  |                                      |
| Number of ECTS credits allocated | 6   | Term             | Semester based (2) |                  |                                      |
| Web                              | <a href="http://personales.unican.es/lafernandez/">http://personales.unican.es/lafernandez/</a> |                  |                    |                  |                                      |
| Language of instruction          | Spanish   | English Friendly | Yes                | Mode of delivery | Face-to-face                         |

|                  |  |  |  |  |  |
|------------------|--|--|--|--|--|
| Department       | DPTO. MATEMATICAS, ESTADISTICA Y COMPUTACION                     |  |  |  |  |
| Name of lecturer | LUIS ALBERTO FERNANDEZ FERNANDEZ                                 |  |  |  |  |
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| Office           | Facultad de Ciencias. Planta: + 3. DESPACHO DE PROFESORES (3007) |  |  |  |  |
| Other lecturers  | MARIA CECILIA POLA MENDEZ  |  |  |  |  |

### 3.1 LEARNING OUTCOMES

- 1) Solving unconstrained optimization problems with computational techniques, including nonlinear least squares.
- 2) Using numerical methods to solve problems associated with ordinary differential equations (ODEs), recognizing stiff problems.
- 3) Using numerical methods to solve problems associated with partial differential equations (PDE) of different types, including the wave, heat and Laplace equations.
- 4) Using MATLAB to solve a variety of problems on the above topics.

#### 4. OBJECTIVES

- 1) Know and know how to use numerical methods to solve unconstrained optimization problems, including the implementation of some of them.
- 2) Know and know how to use numerical methods to solve problems associated with ODE.
- 3) Know and know how to use numerical methods to solve problems associated with different types of PDE .
- 4) Use MATLAB to solve problems on the above topics.

#### 6. COURSE ORGANIZATION

| CONTENTS |   |
|----------|---|
| 1        | Unconstrained optimization. Nonlinear least squares.  |
| 2        | Numerical integration: Gaussian quadrature rules. Numerical solution of ordinary differential equations: Runge-Kutta and multistep methods; stiff problems. |
| 3        | Numerical solution of partial differential equations: finite difference and finite element methods.   |

#### 7. ASSESSMENT METHODS AND CRITERIA

| Description   | Type                  | Final Eval. | Reassessn | %      |
|---|-----------------------|-------------|-----------|--------|
| Partial exam at the end of the first block of the course.   | Laboratory evaluation | Yes         | Yes       | 40,00  |
| Partial exam related to the last two blocks of the course.  | Laboratory evaluation | Yes         | Yes       | 60,00  |
| TOTAL   |                       |             |           | 100,00 |
| Observations  |                       |             |           |        |
| The final mark of the subject will be the weighted average of the marks obtained in the partial exams. To pass the subject it will be needed to obtain a final mark greater than or equal to 5. |                       |             |           |        |
| In the extraordinary call, there will be a global exam which will have a value of 100%.   |                       |             |           |        |
| Observations for part-time students   |                       |             |           |        |
| Evaluation of part-time students will be the same as that of the rest.  |                       |             |           |        |

#### 8. BIBLIOGRAPHY AND TEACHING MATERIALS

##### BASIC

- R. L. Burden y J. D. Faires, "Análisis Numérico", Cengage Learning, 2013.
- C. F. Gerald y P. O. Wheatley, "Applied numerical analysis", Addison-Wesley, 2004.
- J. Nocedal y S. J. Wright, "Numerical Optimization", Springer, 2006.

