# SUBJECT TEACHING GUIDE

## 564 - Fundamentals of environmental modeling

## Master's degree in integrated management of water systems

Academic year 2023-2024

| 1. IDENTIFYING DATA | | | | | |
|---|---|---|---|---|---|
| Degree | Master's degree in integrated management of water systems | | | Type and Year | Compulsory. Year 1 |
| Faculty | School of civil Engineering | | | | |
| Discipline | | | | | |
| Course unit title and code | 564 - Fundamentals of environmental modeling | | | | |
| Number of ECTS credits allocated | 2 | Term | | Semester based (1) | |
| Web | | | | | |
| Language of instruction | Spanish | English Friendly | Yes | Mode of delivery | Face-to-face |

| | |
|---|---|
| Department | DPTO. CIENCIAS Y TECNICAS DEL AGUA Y DEL MEDIO AMBIENTE |
| Name of lecturer | ANDRES GARCIA GOMEZ |
| E-mail | andres.garcia@unican.es |
| Office | E.T.S. de Ingenieros de Caminos, Canales y Puertos. Planta: + 0. DESPACHO DE ANDRES GARCIA GOMEZ (0023) |
| Other lecturers | |

| 3.1 LEARNING OUTCOMES |
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| - To identify the elements that make up a numerical model understanding their role. |
| - To know the options and techniques available to conduct an environmental flows study using a numerical model. |
| - To perform simple numerical integration of one-dimensional problems using discretization techniques. |
| - To criticize the results provided by a numerical model. |

## 4. OBJECTIVES

The main objective is to provide the student an overview of the techniques applied in the simulation of environmental flows problems.

## 6. COURSE ORGANIZATION

| CONTENTS | |
|---|---|
| 1 | Introduction to numerical models. |
| 2 | Discretization techniques: finite difference and finite volume methods. |
| 3 | Introduction to methods for solving equations: methods to solve a system of linear equations, methods to solve ordinary differential equations, methods to solve non-stationary problems. |
| 4 | Computational modelling of environmental flows: numerical models, hydrodynamic modelling, water quality modelling. |

## 7. ASSESSMENT METHODS AND CRITERIA

| Description | Type | Final Eval. | Reassessn | % |
|---|---|---|---|---|
| Introduction to the discretization of a mathematical model | Others | No | Yes | 10,00 |
| Finite differences discretization of equations | Others | No | Yes | 10,00 |
| Finite volume discretization of equations | Others | No | Yes | 10,00 |
| Development of a one-dimensional numerical model for solving an environmental flows problem | Others | No | Yes | 30,00 |
| Final exam | Written exam | Yes | Yes | 40,00 |
| TOTAL | | | | 100,00 |

### Observations

As accorded by the relevant committees, as a general rule, and unless stated otherwise anywhere in this guide:

- A student cannot request a reexamination if the original grade obtained in the evaluation was not a fail .
- The reexamination activity will take the same form than the original evaluation activity.
- Grades are measured on a numeric scale going from 0 to 10, where values smaller than 5 are a Fail.

Marks obtained in the course evaluation activities will be kept until the re-sit examination period.

Only for duly justified reasons (eg sanitary restrictions) the evaluation tests may be organized remotely, with prior authorization from the Center's Administration.

### Observations for part-time students

Part-time students will need to assist to the final exam of the subject and complete practical activities similar to those worked during the course.

| 8. BIBLIOGRAPHY AND TEACHING MATERIALS |
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| BASIC |
| Lomax, H., Pulliam, T. H., Zingg, D. W. (2006). Fundamentals of Computational Fluid Dynamics (Scientific Computation). Springer. |
| Novak, P., Guinot, V., Jeffrey, A., Reeve, D.E. (2010). Hydraulic Modelling - an Introduction. Spon Press. London and New York. |
| Schafer, M. (2006). Computational Engineering - Introduction to Numerical Methods. Springer. Germany. |
| Szymkiewicz, R. (2010). Numerical Modeling in Open Channel Hydraulics. Springer. |