

| Teaching Guide           |  |        |   |           |
|--------------------------|--|--------|---|-----------|
| Identifying Data         |  |        |   | 2018/19   |
| Subject (*)              | Computational fluid dynamics I   |        | Code  | 632844205 |
| Study programme          | Mestrado Universitario en Enxeñaría da Auga (plan 2012)  |        |   |           |
| Descriptors              |  |        |   |           |
| Cycle                    | Period   | Year   | Type  | Credits   |
| Official Master's Degree | 1st four-month period  | First  | Optional  | 6         |
| Language                 | English  |        |   |           |
| Teaching method          | Face-to-face   |        |   |           |
| Prerequisites            |  |        |   |           |
| Department               | Enxeñaría CivilMatemáticas   |        |   |           |
| Coordinador              | Rodríguez-Vellando Fernández-Carvajal,<br>Pablo  | E-mail | pablo.rodriguez-vellando@udc.es   |           |
| Lecturers                | Fe Marques, Jaime<br>Naves García-Rendueles, Acacia<br>Rodríguez-Vellando Fernández-Carvajal,<br>Pablo   | E-mail | jaime.fe@udc.es<br>acacia.naves@udc.es<br>pablo.rodriguez-vellando@udc.es |           |
| Web                      | <a href="http://caminos.udc.es/info/asignaturas/201/masterindex.html">http://caminos.udc.es/info/asignaturas/201/masterindex.html</a>  |        |   |           |
| General description      | Fundamentals of open channel flow and computational fluid dynamics. Fundamental equations: Saint-Venant, Navier-Stokes, potential flow, stream-vorticity, Stokes flow, shallow water, convection-diffusion, Darcy,... Fundamentals of Matlab programming. Finite element programming of hydrodynamic, porous media and geochemical models. Introduction to Finite Volumes. |        |   |           |

| Study programme competences |                             |
|-----------------------------|-----------------------------|
| Code                        | Study programme competences |

| Learning outcomes  |                             |     |    |
|--|-----------------------------|-----|----|
| Learning outcomes  | Study programme competences |     |    |
| Ability to apply the fluid mechanics and the fundamental equations of flow calculation pressure pipes and sheet free.        | A1                          | B1  | C1 |
| Understanding the basics of computational fluid dynamics (CFD). Ability to develop codes that solve incompressible flow both | A1                          | B1  | C1 |
| free surface and porous medium. Knowledge of numerical models applied to hydraulic engineering. Capacity use and analyze     | A1                          | B1  | C1 |
| the results of a hydraulic model. Ability to design, develop and analyze numerical schemes used in a hydraulic model.        | A1                          | B1  | C1 |
|  |                             | B1  | C1 |
|  |                             | B1  | C1 |
|  |                             | B1  | C1 |
|  |                             | B1  | C1 |
|  |                             | B1  |    |
|  |                             | B1  |    |
|  |                             | B1  |    |
|  |                             | B1  |    |
|  |                             | B1  |    |
|  |                             | B1  |    |
|  |                             | BJ1 |    |
|  |                             | BJ1 |    |
|  |                             | BJ1 |    |
|  |                             | BJ1 |    |



| Topic  | Sub-topic  |
|--|--|
| Fundamentals of Open Channel flow (revision) | Open Channel flow  |
| Fundamentals of Computational Fluid Dynamics | Computational Fluid Dynamics   |
| Governing equations                          | Saint-Venant<br>Navier-Stokes<br>Potential flow<br>Stream-vorticity<br>Stokes flow<br>Shallow water<br>Convection-diffusion<br>Darcy,... |
| Fundamentals of Matlab programming           | Matlab programming   |
| Finite Element programming of fluid models   | Hydrodynamic models<br>Porous media models<br>Geochemical models   |
| Fundamentals of Finite Volumes programming   | Finite Volumes programming   |
| Comercial programmes                         | Comercial programmes   |

| Planning  |  |                      |                               |             |
|---|--|----------------------|-------------------------------|-------------|
| Methodologies / tests   | Competencies   | Ordinary class hours | Student?s personal work hours | Total hours |
| Seminar   | A1 A2 A3 A17 B8 B9<br>B10 B11 B12 B13<br>B14 B15 B1 B2 B3 B4<br>B5 B6 B7 B16 B17<br>B18 B19 C1 C2 C3<br>C4 C5 C6 C7 C8 | 30                   | 30                            | 60          |
| Guest lecture / keynote speech  | A1 A2 A3 A17 B8 B9<br>B10 B11 B12 B13<br>B14 B15 B1 B2 B3 B4<br>B5 B6 B7 B16 B17<br>B18 B19 C1 C2 C3<br>C4 C5 C6 C7 C8 | 30                   | 30                            | 60          |
| Personalized attention  |  | 30                   | 0                             | 30          |
| (*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students. |  |                      |                               |             |

| Methodologies                  |  |
|--------------------------------|--|
| Methodologies                  | Description  |
| Seminar                        | Practical lectures related to the theoretical aspects regarded at the magistral lectures |
| Guest lecture / keynote speech | Regular lectures where the main theoretical contents of the subjects are regarded        |

| Personalized attention |  |
|------------------------|--|
| Methodologies          | Description  |
| Seminar                | Personalized attention to be provided for the seminars |

| Assessment    |              |             |               |
|---------------|--------------|-------------|---------------|
| Methodologies | Competencies | Description | Qualification |



|                                   |  |  |    |
|-----------------------------------|--|--|----|
| Guest lecture /<br>keynote speech | A1 A2 A3 A17 B8 B9<br>B10 B11 B12 B13<br>B14 B15 B1 B2 B3 B4<br>B5 B6 B7 B16 B17<br>B18 B19 C1 C2 C3<br>C4 C5 C6 C7 C8 | The knowledge of the concepts developed at the magistral lectures will be assessed and considered for the final mark | 50 |
| Seminar                           | A1 A2 A3 A17 B8 B9<br>B10 B11 B12 B13<br>B14 B15 B1 B2 B3 B4<br>B5 B6 B7 B16 B17<br>B18 B19 C1 C2 C3<br>C4 C5 C6 C7 C8 | The attendance to the seminars and the work being developed at the seminars will be considered for the final mark    | 50 |

## Assessment comments

## Sources of information

|                      |  |
|----------------------|--|
| <b>Basic</b>         | <ul style="list-style-type: none"><li>- G. Carey, J. Oden (1984). Finite Elements. Prentice-Hall</li><li>- A. Chadwick (1986). Hydraulics in Civil Engineering. Allen&amp;Unwin</li><li>- J. Donea (2003). Finite Element Methods for Flow Problems. Wiley</li><li>- P. Gresho, R Sani (2000). Incompressible flow and the finite element method. Wiley</li><li>- O. Pironneau (1989). Finite Element Methods for Fluids. Wiley</li><li>- J. Puertas Agudo (2000). Apuntes de Hidráulica de Canales. Nino</li><li>- Singiresu Rao (2005). The Finite Element Method in Engineering. Elsevier</li><li>- O. C. Zienkiewicz, R.L. Taylor (1982). The Finite Element Method. Vol 3, Fluid dynamics. Mc Graw Hill</li></ul> |
| <b>Complementary</b> |  |

## Recommendations

### Subjects that it is recommended to have taken before

### Subjects that are recommended to be taken simultaneously

### Subjects that continue the syllabus

### Other comments

(\*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.