



Teaching Guide

| Identifying Data | | | | 2015/16 |
|----------------------------|---|---------------|--|----------------|
| Subject (*) | Métodos numéricos aplicados a medios continuos | Code | 730496022 | |
| Study programme | Mestrado Universitario en Enxeñaría Naval e Oceánica (plan 2012) | | | |
| Descriptors | | | | |
| Cycle | Period | Year | Type | Credits |
| Official Master's Degree | 1st four-month period | First | Optativa | 4.5 |
| Language | SpanishGalicianEnglish | | | |
| Teaching method | Face-to-face | | | |
| Prerequisites | | | | |
| Department | Enxeñaría Naval e Oceánica | | | |
| Coordinador | Fariñas Alvariño, Pablo | E-mail | pablo.farinas@udc.es | |
| Lecturers | Fariñas Alvariño, Pablo Mendez Diaz, Abel | E-mail | pablo.farinas@udc.es abel.mendez@udc.es | |
| Web | | | | |
| General description | In this subject the fundamentals and theoretical background of computational naval mechanics, as well as its applicability are studied. The course is based on the finite volume methods and the main objective is to allow the pupils to acquire a knowledge level which permits them to develop their own basic naval models. | | | |

Study programme competences / results

| Code | Study programme competences / results |
|------|---|
| A2 | Coñecemento avanzado da hidrodinámica naval para a súa aplicación á optimización de carenas, propulsores e apéndices. |
| A3 | Coñecemento da dinámica do buque e das estruturas navais, e capacidade para realizar análise de optimización da estrutura da integración dos sistemas a bordo, e do comportamento do buque no mar e da súa manobrabilidade. |
| A7 | Capacidade para proxectar plataformas e artefactos oceánicos. |
| A10 | Coñecemento dos sistemas de posicionamento e da dinámica de plataformas e artefactos. |
| A13 | Coñecemento da enxeñaría de sistemas aplicada á definición dun buque, artefacto ou plataforma marítima mediante a análise e optimización do seu ciclo de vida. |
| B1 | Posuír e comprender coñecementos que acheguen unha base ou oportunidade de ser orixinais no desenvolvemento e/ou aplicación de ideas, a miúdo nun contexto de investigación |
| B2 | Que os estudantes saiban aplicar os coñecementos adquiridos e a súa capacidade de resolución de problemas en ámbitos novos ou pouco coñecidos dentro de contextos máis amplos (ou multidisciplinares) relacionados coa súa área de estudo |
| B3 | Que os estudantes sexan capaces de integrar coñecementos e enfrontarse á complexidade de formular xuízos a partir dunha información que, sendo incompleta ou limitada, inclúa reflexións sobre as responsabilidades sociais e éticas vinculadas á aplicación dos seus coñecementos e xuízos |
| B4 | Que os estudantes saiban comunicar as súas conclusións e os coñecementos e razóns últimas que as sustentan a públicos especializados e non especializados dun modo claro e sen ambigüidades. |
| B5 | Que os estudantes posúan as habilidades de aprendizaxe que lles permitan continuar estudando dun modo que haberá de ser en boa medida autodirixido ou autónomo. |
| B6 | Ser capaz de realizar unha análise crítica, avaliación e síntese de ideas novas e complexas. |
| B7 | Falar ben en público |
| C1 | Utilizar as ferramentas básicas das tecnoloxías da información e as comunicacións (TIC) necesarias para o exercicio da súa profesión e para a aprendizaxe ao longo da súa vida. |

Learning outcomes

| Learning outcomes | Study programme competences / results |
|-------------------|---------------------------------------|
| | |



| | | | |
|--|------|-----|-----|
| Knowing and understanding the numerical model based on the fundamental equations. | AC2 | BC1 | CC1 |
| Modelling and understanding the fundamental phenomenologies which govern the naval hydrodynamics. | AC3 | BC2 | |
| Analyzing the computational results, from a general perspective, in complex ship hydrodynamic cases. | AC7 | BC3 | |
| | AC10 | BC4 | |
| | AC13 | BC5 | |
| | | BC6 | |
| | | BC7 | |

| Contents | |
|--|--|
| Topic | Sub-topic |
| Remembering conservation laws: | Conservation laws (mass and momentum). Combined convection / diffusion |
| Pressure velocity coupling algorithms: | Introduction to the closure problem. Numerical versus physical incompressibility. Staggered grids. SIMPLE/ER/C and PISO methods for staggered grids. SIMPLE/ER/C and PISO methods for collocated grids. Implementing cases. |
| Linear equations systems: | Sparse matrix systems. Point to point, line to line and plane to plane methods. High and low frequency errors. Multigrid methods. Conjugate gradient method. Implementing cases |
| Unsteady problems: | Explicit, implicit and fully implicit schemes in 1D transient pure diffusive case. Extension to 3D case. Combined advection diffusion transient case. Transient pressure velocity coupling. Implementing cases. |
| Special Boundaries: | Remembering Dirichlet and von Neumann boundaries. Combined boundary conditions. Wall laws. Special boundaries. Free surface. |
| Cases over commercial software: | Proposed cases by the professor. |

| Planning | | | | |
|--------------------------------|--|--------------------------------------|-------------------------------|-------------|
| Methodologies / tests | Competencies / Results | Teaching hours (in-person & virtual) | Student?s personal work hours | Total hours |
| Introductory activities | A2 A3 A7 A10 A13 B2 B3 B5 B6 C1 | 2 | 1 | 3 |
| Guest lecture / keynote speech | A2 A3 A7 A10 A13 B1 B2 B3 B5 B6 C1 | 25 | 25 | 50 |
| Case study | A2 A3 A7 A10 A13 B1 B2 B3 B5 B6 C1 | 8 | 8 | 16 |
| Simulation | A2 A3 A7 A10 A13 B2 B3 B4 B5 B6 B7 C1 | 7 | 31.5 | 38.5 |
| Objective test | B2 B6 C1 | 3 | 0 | 3 |
| Personalized attention | | 2 | 0 | 2 |

(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.



| Methodologies | |
|--------------------------------|---|
| Methodologies | Description |
| Introductory activities | Remembering mechanics fundamentals. |
| Guest lecture / keynote speech | Are the typical lectures. |
| Case study | Cases resolutions solved during the lectures. |
| Simulation | Running a commercial solver. |
| Objective test | Is the exam. |

| Personalized attention | |
|--|--|
| Methodologies | Description |
| Guest lecture / keynote speech Simulation | Is the support for the homework development. |

| Assessment | | | |
|----------------|--|---|---------------|
| Methodologies | Competencies / Results | Description | Qualification |
| Simulation | A2 A3 A7 A10 A13 B2 B3 B4 B5 B6 B7 C1 | It is compulsory, under professor demand, to deliver the proposed home tasks and simulations on time along this course. The delivered tasks and simulations will be assessed by the professor and will be considered for the final qualification. | 40 |
| Objective test | B2 B6 C1 | Is the exam. | 60 |

| Assessment comments |
|---|
| In order to pass this subject it is necessary to achieve a qualification above four over ten in the exam. It is also necessary to deliver the required homework in the correct manner and up to the limiting required time. In case the homework is not delivered in the correct way and time the pupil will lose the possibility to pass this subject. |

| Sources of information | |
|------------------------|--|
| Basic | <ul style="list-style-type: none"> - Pablo Fariñas (2013). Apuntes de clase. - Maliska C.R. (1995). Transferencia de calor e mecánica de fluidos computacional.. LTC editora - Versteeg H.K. & Malalasekera W. (1995). Computational fluid dynamics, the finite volume method.. Longmann - Hildebrand F.B. (1976). Advanced calculus for applications. Prentice hall |
| Complementary | |

| Recommendations |
|---|
| Subjects that it is recommended to have taken before |
| Subjects that are recommended to be taken simultaneously |
| Hidrodinámica naval avanzada/730496002 Diseño e optimización de estructuras navais/730496003 Ampliación de hidrostática e hidrodinámica/730496020 |
| Subjects that continue the syllabus |
| Other comments |
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(*)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.