



## Guía docente

| Guía docente          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                    |                               |           |
|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-------------------------------|-----------|
| Datos Identificativos |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                    |                               | 2024/25   |
| Asignatura (*)        | Sistemas Inteligentes de Soporte a las Decisiones                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                    | Código                        | 730542013 |
| Titulación            | Master Universitario Erasmus Mundus en Sostibilidade e Industria 4.0 aplicada ao Sector Marítimo                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |                               |           |
| Descriptor            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                    |                               |           |
| Ciclo                 | Periodo                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Curso              | Tipo                          | Créditos  |
| Máster Oficial        | 2º cuatrimestre                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Primero            | Obligatoria                   | 6         |
| Idioma                | Inglés                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                    |                               |           |
| Modalidad docente     | Presencial                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                    |                               |           |
| Prerrequisitos        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                    |                               |           |
| Departamento          | Enxeñaría Naval e Industrial                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                    |                               |           |
| Coordinador/a         | Santiago Caamaño, Lucía                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Correo electrónico | lucia.santiago.caamano@udc.es |           |
| Profesorado           | Miguez Gonzalez, Marcos                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Correo electrónico | marcos.miguez@udc.es          |           |
|                       | Santiago Caamaño, Lucía                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                    | lucia.santiago.caamano@udc.es |           |
| Web                   | http://www.master-seas40.unina.it                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                    |                               |           |
| Descripción general   | The overall aim of the course is to provide an understanding of the engineering and mathematical analyses that form the basics of monitoring and decision support systems used for onboard/navigational guidance of ships. These techniques are used by naval architects and engineers in the technical departments of ship owners, in classification societies and ship consultancies. Moreover, the student will be trained in advanced methods to evaluate ship operations with regards to the increased focus on energy consumption and emissions from ship. |                    |                               |           |

## Competencias / Resultados del título

| Código | Competencias / Resultados del título                                                                                                                                                                                                                                                |
|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A6     | CE6 - Demonstrate knowledge, understanding and competences in fulfilling safety, economic and sustainability requirements in ship operation and management (SO).                                                                                                                    |
| B2     | CB6 - Acquire and understand knowledge that provides a basis or opportunity to be original in the development and / or application of ideas, usually in a research context.                                                                                                         |
| B3     | CB7 - That students know how to apply the acquired knowledge and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of study.                                                                   |
| B4     | CB8 - That students are able to integrate knowledge and face the complexity of making judgments based on information that, being incomplete or limited, includes reflections on the social and ethical responsibilities linked to the application of their knowledge and judgments. |
| B5     | CB9 ? That students are able to communicate their conclusions -and the knowledge and ultimate reasons that sustain them- to specialized and non-specialized publics in a clear and unambiguous way.                                                                                 |
| B6     | CB10 - That students have the learning skills that allow them to continue studying in a way that will be largely self-directed or autonomous.                                                                                                                                       |
| B7     | CG1 ? To display the adequate intercultural competence to successfully navigating within multicultural learning environments and to implement basic management principles suitable for a multicultural working environment.                                                         |
| B8     | CG2 ? To express an attitude of intellectual inquisitiveness and open-mindedness.                                                                                                                                                                                                   |
| B11    | CG5 ? To have the capability to identify, formulate and solve engineering problems within realistic constraints.                                                                                                                                                                    |
| B12    | CG6 ? To appreciate the impact of sustainable development goals in maritime transport.                                                                                                                                                                                              |
| B13    | CG7 ? To have the capability to critically analyse, synthesise, interpret and summarise complex scientific processes.                                                                                                                                                               |
| C2     | CT2 - Mastering oral and written expression in a foreign language.                                                                                                                                                                                                                  |
| C3     | CT3 - Using ICT in working contexts and lifelong learning.                                                                                                                                                                                                                          |
| C4     | CT4 - Acting as a respectful citizen according to democratic cultures and human rights and with a gender perspective.                                                                                                                                                               |
| C6     | CT6 - Acquiring skills for healthy lifestyles, and healthy habits and routines.                                                                                                                                                                                                     |
| C7     | CT7 -Developing the ability to work in interdisciplinary or transdisciplinary teams in order to offer proposals that can contribute to a sustainable environmental, economic, political and social development.                                                                     |

## Resultados de aprendizaje



| Resultados de aprendizaje                                                                                                                                                                                                     | Competencias / Resultados del título |                                                                       |                                 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|-----------------------------------------------------------------------|---------------------------------|
| Understanding of monitoring and decision support systems used for onboard/navigational guidance of ships and capability to evaluate and optimize ship operations with regards to energy consumption and emissions and safety. | AM6                                  | BM1<br>BM2<br>BM3<br>BM4<br>BM5<br>BM6<br>BM7<br>BM10<br>BM11<br>BM12 | CM2<br>CM3<br>CM4<br>CM6<br>CM7 |

| Contenidos                     |                                                                                                                       |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| Tema                           | Subtema                                                                                                               |
| Random processes               | Mathematical representation and tools for analysis of stochastic processes (time and frequency domains); ocean waves. |
| Modelling of dynamical systems | State space and input-output models for linear systems; response amplitude operators.                                 |
| Seakeeping                     | Methods for computation and assessment of ship responses in waves; motions, loads and fuel consumption.               |
| Signal processing              | Methods and tools for processing of noisy signals in the time and frequency domain.                                   |
| Estimation theory              | Parametric methods for estimation of signals; Kalman filtering and particle filtering; sea state estimation.          |
| Detection theory               | Statistical learning; detection methods for Gaussian and non-Gaussian processes.                                      |
| Decision support systems       | Design of decision support systems; human factors; study cases on safe marine operations and fuel efficiency.         |

| Planificación                                                                                                                     |                                                   |                                           |                        |               |
|-----------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|-------------------------------------------|------------------------|---------------|
| Metodologías / pruebas                                                                                                            | Competencias / Resultados                         | Horas lectivas (presenciales y virtuales) | Horas trabajo autónomo | Horas totales |
| Sesión magistral                                                                                                                  | A6 B2 B3 B4 B7 B12<br>C2 C4 C6                    | 28                                        | 42                     | 70            |
| Prueba mixta                                                                                                                      | A6 B2 B3 B4 B6 B11<br>B13 C2                      | 2                                         | 0                      | 2             |
| Trabajos tutelados                                                                                                                | A6 B2 B3 B4 B5 B6<br>B7 B8 B11 B13 C2<br>C3 C4 C7 | 5                                         | 42.5                   | 47.5          |
| Presentación oral                                                                                                                 | B5 B13 C2 C3 C7                                   | 1                                         | 4                      | 5             |
| Prácticas a través de TIC                                                                                                         | A6 B3 B11 C3                                      | 9                                         | 13.5                   | 22.5          |
| Atención personalizada                                                                                                            |                                                   | 3                                         | 0                      | 3             |
| (*)Los datos que aparecen en la tabla de planificación són de carácter orientativo, considerando la heterogeneidad de los alumnos |                                                   |                                           |                        |               |

| Metodologías |             |
|--------------|-------------|
| Metodologías | Descripción |



|                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Sesión magistral          | <p>Oral presentation (using audiovisual material and student interaction) designed to transmit knowledge and encourage learning. Presentations of this type are variously referred to as 'expository method?', 'guest lectures?' or 'keynote speeches?.'</p> <p>In this course, these presentations will be made by different professors, both from the UDC and from DTU.</p>                                                                                                                                                                                                                                 |
| Prueba mixta              | Mixed test consisting of essay-type and objective test questions. Essay section consists of open (extended answer) questions; objective test may contain multiple-choice, ordering and sequencing, short answer, binary, completion and/or multiple-matching questions.                                                                                                                                                                                                                                                                                                                                       |
| Trabajos tutelados        | <p>Supervised learning process aimed at helping students to work independently in a range of contexts (academic and professional). Focused primarily on learning 'how to do things?' and on encouraging students to become responsible for their own learning.</p> <p>In this course, the supervised project will consist on a group based technical report based on an assignment done by the professors, and dealing about some of the topics of the course. This report may be presented in front of the rest of students. This fact will be announced in Moodle/Teams at the beginning of the course.</p> |
| Presentación oral         | <p>Core component of teaching-learning process involving coordinated oral interaction between student and teacher, including proposition, explanation and dynamic exposition of facts, topics, tasks, ideas and principles.</p> <p>In this course, the oral presentation will consist on the presentation of the technical report in front of the rest of students and the professors.</p>                                                                                                                                                                                                                    |
| Prácticas a través de TIC | <p>Practice-based learning method for theoretical subject content using ICT resources (demonstrations, simulations, etc.) ICT is an excellent medium for practical knowledge applications and information processing, and a key aid to student learning and skills development.</p> <p>In this course, MATLAB will be used to implement some of the systems described during the theoretical lectures.</p>                                                                                                                                                                                                    |

## Atención personalizada

| Metodologías              | Descripción                                                                                                                                                                                                                                                                                                                                              |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Sesión magistral          | <p>The professors will provide personalized attention to the students both personally and remotely using MS Teams or email.</p> <p>In this course, this personalized attention will consist on support while developing the supervised projects, the ICT practicals and doubts and questions related to the contents elaborated during the lectures.</p> |
| Trabajos tutelados        |                                                                                                                                                                                                                                                                                                                                                          |
| Prácticas a través de TIC |                                                                                                                                                                                                                                                                                                                                                          |

## Evaluación

| Metodologías       | Competencias / Resultados                   | Descripción                                                                                                                                                                                                                                      | Calificación |
|--------------------|---------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| Trabajos tutelados | A6 B2 B3 B4 B5 B6 B7 B8 B11 B13 C2 C3 C4 C7 | <p>The qualification of the group based technical report will represent a 40 % of the student's final qualification.</p> <p>In case the oral presentation is not finally programmed, the percentage of the supervised projects will be 50 %.</p> | 40           |
| Prueba mixta       | A6 B2 B3 B4 B6 B11 B13 C2                   | The qualification of the theoretical exam of this course will represent a 50 % of the student's final qualification.                                                                                                                             | 50           |
| Presentación oral  | B5 B13 C2 C3 C7                             | In case the oral presentation is finally programmed, the percentage of its qualification will be a 10 %, including the presentation and the answers to the questions formulated by the professors and other students.                            | 10           |

## Observaciones evaluación



According to the degree regulations, the students will have the opportunity to pass this course in two opportunities (first and second opportunity). In order to pass the course, an overall mark of 5 out of 10 should be obtained by applying the percentages above to each of the methodologies, considering each of them evaluated in a scale from 0 to 10. At the beginning of the course, dates for presenting the technical reports and doing the oral presentation will be published in Moodle/ MS Teams. In the second opportunity, students will be able to repeat the exam and correct/modify the technical reports; however, in order to pass the course, both the technical report and the oral presentation should have been done in any case fulfilling the prescribed deadlines set during the course. General EMJMD Sustainable Ship and Shipping SEAS 4.0 evaluation rules:- Students will have only two opportunities to pass a course. If failing to do so, they may be forced to leave the degree.- No part time or lecture attendance exemption are allowed in this degree.

## Fuentes de información

|                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Básica</b>         | <p>Simon D., ?Optimal State Estimation ? Kalman, H_infinity, and Nonlinear Approaches?, Wiley, 2006. Kay S.M., ?Fundamentals of Statistical Signal Processing ? Detection Theory?, Prentice Hall, 1998. Papoulis A., Unnikrishna Pillai S., ?Probability, Random Variables, and Stochastic Processes?, McGraw-Hill 2002. Ochi M.K., ?Ocean Waves ? The Stochastic Approach?, Cambridge University Press, 2009. Payer and Ratheje (2004): Shipboard Routing Assistance - Decision Making Support for Operation of Container Ships in Heavy Seas, SNAME Trans., Vol. 112, pp. 1-12, 2004. Nielsen et al. (2006): SeaSense ? Real-time Onboard Decision Support, in Proc. World Maritime Technology Conference. Jensen et al. (2004): Estimation of ship motions using closed-form expressions, Ocean Engineering, Vol. 31, pp. 61-85, 2004. Simon D., ?Optimal State Estimation ? Kalman, H_infinity, and Nonlinear Approaches?, Wiley, 2006. Kay S.M., ?Fundamentals of Statistical Signal Processing ? Detection Theory?, Prentice Hall, 1998. Papoulis A., Unnikrishna Pillai S., ?Probability, Random Variables, and Stochastic Processes?, McGraw-Hill 2002. Ochi M.K., ?Ocean Waves ? The Stochastic Approach?, Cambridge University Press, 2009. Payer and Ratheje (2004): Shipboard Routing Assistance - Decision Making Support for Operation of Container Ships in Heavy Seas, SNAME Trans., Vol. 112, pp. 1-12, 2004. Nielsen et al. (2006): SeaSense ? Real-time Onboard Decision Support, in Proc. World Maritime Technology Conference. Jensen et al. (2004): Estimation of ship motions using closed-form expressions, Ocean Engineering, Vol. 31, pp. 61-85, 2004.</p> |
| <b>Complementaria</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

## Recomendaciones

### Asignaturas que se recomienda haber cursado previamente

Criterios de Estabilidad de Segunda Generación/730542006  
 Comportamiento del Buque en la Mar/730542008

### Asignaturas que se recomienda cursar simultáneamente

Maniobrabilidad e Hidrodinámica en Aguas Someras/730542012

### Asignaturas que continúan el temario

## Otros comentarios

To help in achieving a sustainable environment and to get the objective of number 5 action of the "Ferrol Green Campus Action Plan" (Healthy and environmental and socially sustainable research and teaching): The assignments to be done in this course:- Will be required in digital format.- Will be delivered using Moodle, with no need to print them. In case it is necessary to print them:- Plastics won't be used.- Two side printing will be used.- Recycled paper will be used.- Printing drafts will be avoided. A sustainable use of the resources should be done, together with the prevention of negative impacts on the environment. In this course, an effort will be pursued towards the incorporation of gender inclusion aspects: no sexist language will be allowed and the participation of students of both gender in class will be promoted. The situations of gender discrimination will be detected, and actions will be implemented to correct them. The full integration of students who for physical, sensorial, psychic, or socio-cultural reasons may have difficulties in their academic life will be promoted.



(\*) La Guía Docente es el documento donde se visualiza la propuesta académica de la UDC. Este documento es público y no se puede modificar, salvo cosas excepcionales bajo la revisión del órgano competente de acuerdo a la normativa vigente que establece el proceso de elaboración de guías