Teaching Guide			
Identifying Data			2023/24
Subject (*)	Simulation and Optimization of Shipbuilding Processes	Code	730542024
Study programme	Master Universitario Erasmus Mundus en Sostibilidade e Industria 4.0 aplicada ao Sector Marítimo		

Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	1st four-month period	Second	Optional	6

Language	English		
Teaching method	Face-to-face		
Prerequisites			
Department	Empresa		
Coordinador	Pernas Álvarez, Javier	E-mail	javier.pernas2@udc.es
Lecturers	Lamas Rodriguez, Adolfo Pernas Álvarez, Javier	E-mail	adolfo.lamasr@udc.es javier.pernas2@udc.es
Web			
General description	The goal of this subject is to provide a basic theoretical and practical understanding of modelling and simulation technologies (M&S) applied to shipbuilding. M&S is considered one of the Industry 4.0 technologies that allows shipyards to optimize manufacturing processes and logistics. The simulation software Flexsim will be used to solve practical cases based on real problems solved in shipyards.		

Study programme competences / results	
Code	Study programme competences / results
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.
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.

Learning outcomes			
Learning outcomes	Study programme competences / results		
Knowledge of the methods and strategies applied to shipbuilding.		BC6 BC7 BC10 BC12	CC2 CC3 CC4 CC6 CC7
Capacity to understand and to implement simulation and optimization of shipbuilding processes.		BC6 BC7 BC10 BC12	CC2 CC3 CC4 CC6 CC7

Contents

Topic	Sub-topic
Modelling and Simulation	The M&S methodology. M&S technologies. Simulation projects.
Model development in Flexsim	Flexsim basics. Fixed resource library. Task executers. Networks and conveyors. Introduction to process flows.
Shipbuilding processes	Cutting-welding. Block assembly. Outfitting. Painting. Blocks erection.
Shipyard simulation.	Material receipts. Assembly workstations. Blocks erection. Cranes. Planning.
Optimization	Input data analysis. Simulation experiments. Optimization concepts. Linear models. Heuristics. Evolutionary algorithms.

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
ICT practicals	A2 A3 B7 B8 B11 B13 C2 C3 C4 C6 C7	15	15	30
Case study	B7 B8 B11 B13 C2 C3 C4 C6 C7	4.5	22.5	27
Supervised projects	A2 A3 B7 B8 B11 B13 C2 C3 C4 C6 C7	1.5	40.5	42
Mixed objective/subjective test	B7 B8 B11 B13 C2 C3 C4 C6 C7	2	2	4
Guest lecture / keynote speech	A2 A3 B8 B11 B13	21	21	42
Personalized attention		5	0	5
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	Description
ICT practicals	Solving practical problems and case studies using Flexsim.
Case study	Solving practical cases proposed by the teachers
Supervised projects	Simulation project proposed by the teachers
Mixed objective/subjective test	Final exam about the contents of this subject.
Guest lecture / keynote speech	Lectures on the subject contents

Personalized attention	
Methodologies	Description
ICT practicals Mixed objective/subjective test Guest lecture / keynote speech Case study Supervised projects	During tutorial time, students can meet the teachers to clarify the doubts of the subject, as well as the ones concerning the supervised projects

Assessment			
Methodologies	Competencies / Results	Description	Qualification

Mixed objective/subjective test	B7 B8 B11 B13 C2 C3 C4 C6 C7	Assessment of the final exam	20
Case study	B7 B8 B11 B13 C2 C3 C4 C6 C7	Assessment of the practical cases assigned to the students.	20
Supervised projects	A2 A3 B7 B8 B11 B13 C2 C3 C4 C6 C7	Assessment of the supervised project assigned to the students.	60

Assessment comments
Assessment criteria Second opportunity The assessment criteria for the first and the second opportunity are the same. 'No Presentado' grade The grade of "No presentado" (no grade) will be given to those students who will not hand in the supervised project. Additional information According to Article 11, section 4 b) of the "Reglamento disciplinar del estudiantado de la UDC", engaging in fraudulent behavior in any of the methodologies subject to assessment sections will result in a grade of "Fail (0)" for the final evaluation, both in the first and second opportunity, regardless of the opportunity in which the offense was committed. General EMJMD Sustainable Ship and Shipping SEAS 4.0 evaluation rules: - Students will have only two oportunities 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.

Sources of information	
Basic	- Robinson, Stewart (2004). Simulation : The Practice of Model Development and Use. John Wiley & Sons - Flexsim (2022). Flexsim Tutorials. - Banks, Jerry Carson, Jhon S. Nelson, Barry L. Nicol, David M. (2010). Discrete-Event System Simulation. Prentice Hall
Complementary	

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

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 environmentaly 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, bibliography from authors of both genders will be used, 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.