Teaching Guide				
Identifying Data				2020/21
Subject (*)	Control Systems		Code	730496227
Study programme	Mestrado Universitario en Enxeñaría Naval e Oceánica (plan 2018)			
Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	1st four-month period	First	Optional	4.5
Language	SpanishGalician			
Teaching method	Face-to-face			
Prerequisites				
Department	Enxeñaría Naval e IndustrialEnxeñaría Naval e Oceánica			
Coordinador	Bouza Fernandez, Javier	E-mail	javier.bouza@udc.es	
Lecturers	Bouza Fernandez, Javier	E-mail	javier.bouza@udc.es	
Web				
General description	Nesta materia plásmase a descrición, análise, funcionamento, selección e utilización dos elementos e sistemas de control e regulación dos equipos e servizos empregados no buque e Artefactos Off- shore, así como a súa supervisión e monitoraxe. Ademais abórdanse diferentes Técnicas e metodoloxías para o deseño e implementación dos sistemas de control.			
Contingency plan	1. Modifications to the contents 2. Methodologies *Teaching methodologies that are maintained *Teaching methodologies that are modified 3. Mechanisms for personalized attention to students 4. Modifications in the evaluation *Evaluation observations: 5. Modifications to the bibliography or webgraphy			

Study programme competences / results	
Code	Study programme competences / results
B6	G01 Capacidade para resolver problemas complexos e para tomar decisións con responsabilidade sobre a base dos coñecementos científicos e tecnolóxicos adquiridos en materias básicas e tecnolóxicas aplicables na enxeñaría naval e oceánica, e en métodos de xestión.
B10	G05 Capacidade para deseñar e controlar os procesos de construción, reparación, transformación, mantemento e inspección dos enxeños anteriores.
B11	G06 Capacidade para realizar investigación, desenvolvemento e innovación en produtos, procesos e métodos navais e oceánicos.
B19	G14 Capacidade para analizar, valorar e corrixir o impacto social e ambiental das solucións técnicas
C2	C1 Capacidade pra desenrolar a actividade profesional nun entorno multilingue
C3	ABET (a) An ability to apply knowledge of mathematics, science, and engineering.
C7	ABET (e) An ability to identify, formulate, and solve engineering problems.

Learning outcomes

Learning outcomes	Study programme competences / results		
1. Adquirir o coñecemento teórico e práctico dos sistemas de control e regulación aplicados a bordo do Buque e Artefactos Off- shore		BJ1 BJ5 BJ6 BJ14	CC2 CC3
2. Análise e aplicación de diferentes metodoloxías para o deseño e implementación.		BJ1 BJ5 BJ6 BJ14	CC2 CC3 CC7

Contents	
Topic	Sub-topic
Tema 1: Sistemas de control en buques e Artefactos Offshore.	Vantaxes do uso a bordo. Compoñentes e características específicas das instalacións navais. Regulamentación e Normativas aplicables. Clasificación dos sistemas de regulación e control. Especificacións e execución do proxecto dunha instalación.
Tema 2: Máquinas e servizos nos que se empregan os sistemas de control e regulación.	Máquinas Eléctricas, Hidráulicas, Neumáticas, Térmicas e Mixtas. Características e réxime das máquinas para controlar e regular. Problemáticas e avarías nas máquinas e servizos en condicións mariñas.
Tema 3: Metodoloxías de deseño.	Análise de diferentes métodos. Aplicación práctica dos métodos e o seu uso. Condicionantes e limitacións na súa implementación.
Tema 4: Implementación de sistemas de control.	Aspectos xerais. . Condicionantes e limitacións na implementación. Interfaces Home-Máquina (HMI). Seguridade.
Tema 5: Casos prácticos I - Sistemas de control e regulación.	Análise e desenvolvementos de exemplos prácticos en Laboratorio.
Tema 6: Casos prácticos II- Sistemas de Supervisión y monitorización del control.	Desenvolvemento e implementación de modelos prácticos.
Nota:	As seis unidades didácticas coas súas subtemas desenvolven os contidos establecidos na Memoria de Verificación.

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Guest lecture / keynote speech	B6 B10 B11 B19 C2	15	5	20
Problem solving	A5 A8 A11 A14 B6 B10 B11 B19	10	20	30
Laboratory practice	B6 B10 B11 C3 C7	20	18.5	38.5
Supervised projects	B6 B10 B11 B19 C2	0	20	20
Mixed objective/subjective test	A5 A8 A11 A14 B6 B10	3	0	3
Personalized attention		1	0	1
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	Description
Guest lecture / keynote speech	Programa da materia
Problem solving	Formulación e solución de problemas e casos reais no sector naval

Laboratory practice	Simulación e análise dos sistemas de control e regulación no Laboratorio. Desenvolverase conxunto de prácticas empregando os coñecementos aplicados das as tecnoloxías mecánica, hidráulica, neumática, eléctrica e electrónica.
Supervised projects	Traballos de desenvolvemento e análise guiados polo Profesor sobre temáticas e aspectos dos sistemas de control
Mixed objective/subjective test	Fundamentada nos contidos e nas prácticas realizadas no Laboratorio

Personalized attention	
Methodologies	**Description**
Mixed objective/subjective test Supervised projects Laboratory practice	Debido a que cada alumno ten diferente grao de asimilación é importante resolver de forma individual as súas dúbidas e preguntas, xa sexa na aula, no despacho(en horario de titorías), a través do correo electrónico, ou mediante úsoo de plataformas TIC (Skype e grupo google). Empregarase o grupo google para o seguimento do curso.

Assessment			
Methodologies	**Competencies / Results**	**Description**	**Qualification**
Mixed objective/subjective test	A5 A8 A11 A14 B6 B10	Fundamentada nos contidos prácticos e nas prácticas realizadas no Laboratorio	40
Supervised projects	B6 B10 B11 B19 C2	Traballos de desenvolvemento e análise guiados polo Profesor sobre temáticas e aspectos dos sistemas de control	40
Laboratory practice	B6 B10 B11 C3 C7	Realización de actividades de carácter práctico e de Laboratorio	20

Assessment comments
1º Convocatoria: A cualificación das metodoloxías realizásese con notas sobre 10 e será condición necesaria para superar a avaliación non ter ningunha nota inferior a 3,5 nos Traballos Tutelados e Prácticas de Laboratorio e ter unha asistencia ás actividades presenciais de polo menos o 80%. 2º oportunidade, Convocatoria extraordinaria ou Dispensa académica: A avaliación realízase mediante unha proba mixta que consta, á súa vez, de dúas probas: A primeira unha Proba Obxectiva e a segunda unha Proba de Ensaio e desenvolvemento no Laboratorio. La calificación de los módulos o prueba se realizará con notas sobre 10 y será condición necesaria para superar la evaluación: no tener ninguna nota inferior a 3,5 en las mismas. La nota final será: (0,6 * Proba obxectiva + 0,4 * Proba práctica) / (Número de notas inferiores que 3,5 + 1)

Sources of information

Basic	Aquilino R. Penin, ?Sistemas SCADA?. Marcombo S.A, 2006. Siemens, Controlador programable S7-1200- Manual de sistema, 06/2015, A5E02486683-AJ. Siemens, ?Manual de Programación. Software de Sistema para S7-1200. Diseño de programas?, Ref.: 6ES7-810-4CA04-8DA0, 2000. "PLC Programming Example - Hydraulic Press", 2012, . "PLCs, hydraulics improve slant rig shallow-drilling operations", 2001, Oil and Gas Journal, vol. 99, no. 9, pp. 86-89. "Proceedings of the 1997 7th Annual ISA POWID/EPRI Controls and Instrumentation Conference", 1997, Instrumentation, Control, and Automation in the Power Industry, Proceedings. "Ventajas del PLC en control de procesos", 2001, Industria internacional, vol. 37, no. 398, pp. 28. Álvarez, M.E.V., Antón, J.C., Blanco-Viejo, C. & Ferrero, F.J. 2000, "Fully automatic guardrail packed machine", IEEE International Symposium on Industrial Electronics, pp. 777. 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De las Heras Jimenez, Salvador Augusto 2003 ?Tecnología digital en válvulas neumáticas?, Automática e instrumentación, num. 346, p. 60-68. De las Heras, Salvador Augusto, 2011,?Fluidos, bombas e instalaciones hidráulicas?, ISBN 9788476538012 Drumea, A. & Blejan, M. 2013, "Design, implementation and testing of an electrohydraulic system for automated winding machine for aluminum wire rods", 2013 International Conference on Electronics, Computers and Artificial Intelligence, ECAI 2013. Du, L. Hydrostatic machine ultra low speed control structure, has position sensor placed on hydraulic cylinder whose position signal is fed back and connected with programmable logic controller. Dufo López, R. & Bernal Agustín, J.L. 2007, Dimensionado y control óptimos de sistemas híbridos aplicando algoritmos evolutivos. 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Complementary	

Recommendations
Subjects that it is recommended to have taken before
Subjects that are recommended to be taken simultaneously
Air Conditioning and Refrigeration/730496226 Machines and Marine Thermal Engines/730496219 Ship Equipment and Services/730496220 Propulsion Systems/730496218 New Naval Engineering Technologies/730496224
Subjects that continue the syllabus
Master Thesis/730496023 Masters Thesis/730496216
Other comments
?Para axudar a conseguir unha contorna inmediata sostida e cumprir co obxectivo da acción número 5: ?Docencia e investigación saudable e sustentable ambiental e social? do "Plan de Acción Green Campus Ferrol": A entrega dos traballos documentais que se realicen nesta materia: ? Solicitaranse en formato virtual e/ou soporte informático ? Realizarase a través de plataformas de almacenamiento (Google drive,..), en formato dixital sen necesidade de imprimilos ? En caso de ser necesario realizalos en papel: - Non se empregarán plásticos - Realizaranse impresións a dobre cara. - Empregarase papel reciclado. - Evitarase a impresión de borradores.