



Teaching Guide

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 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 realizáse 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: $(0,6 * \text{Proba obxectiva} + 0,4 * \text{Proba práctica}) / (\text{Número de notas inferiores que } 3,5 + 1)$

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. Alvarez, M.E.V., Blanco-Viejo, C., Anton, J.C. & Ferrero, F.J. 2000, "Fully automatic guardrail packed machine", Industrial Electronics, 2000. ISIE 2000. Proceedings of the 2000 IEEE International Symposium on, pp. 777. Cahill, L. 2006, "Hydraulic valves and logic processors on medium to small dams: The future of dam automation", Operating Reservoirs in Changing Conditions - Proceedings of the Operations Management 2006 Conference, pp. 139. Canuto, E. & Acuna-Bravo, W. 2013, "Hierarchical digital control of a proportional electro-hydraulic valve", Mechatronics and Automation (ICMA), 2013 IEEE International Conference on, pp. 1015. Colon, E., Polome, D., Piedfort, V. & Baudoin, Y. 1995, "AMRU 3: teleoperated six-legged electrohydraulic robot", Proceedings of SPIE - The International Society for Optical Engineering, pp. 192. Cortes Osorio, J.A., Mendoza Vargas, J.A. & Muriel Escobar, J.A. 2012, "Control y supervisión de un sistema pick and place neumático a través de un PLC y un sistema SCADA", Scientia et Technica, vol. 2, no. 50, pp. 141-146. CUNTANG, W. & GUILIN, W. 2014, "Full-automatic plate shearer hydraulic system based on PLC (programmable logic controller) control". CUNTANG, W. & GUILIN, W. 2014, "Full-automatic plate shearing machine hydraulic system on basis of PLC control". Davies, R.M. & Watton, J. 1995, "Intelligent control of an electrohydraulic motor drive system", Mechatronics, vol. 5, no. 5, pp. 527-540. De las Heras, Salvador & Carbo, Albert & Bouza, Javier 2011, "Detección de fugas en sistemas de aire comprimido", Automática e instrumentación, num. 430, p. 61-66. De las Heras Jimenez, Salvador Augusto 2005 "Medidas de caudal en sistemas neumáticos", Automática e instrumentación, num. 366, p. 66-72. 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. Evans, D.S. 1995, "Condition monitoring of sequential fluid power systems using programmable logic controllers", Application of Advanced PLC (Programmable Logic Controller) Systems with Specific Experiences from Water Treatment, IEE Colloquium on (Digest No.1995/112), pp. 4/1. Evans, D.S. 1995, "Simulation modelling of sequential fluid power systems using integrated PLC/PC development aids", IEE Colloquium (Digest). FUHAI, L.I.U. & HONGXIAN, L.I.U. 2011, "Hydraulic system unloading device for forging hydraulic press and based on PLC control", . García Pinzon, J.A. & Mendoza, L.E. 2014, "Adquisición y procesamiento de señales emg para controlar movimiento de un brazo hidráulico", Mundo FESC, vol. 1, no. 7, pp. 49-60. García Sampedro, A. 2007, "Control remoto rápido y sencillo: estación de control remoto, PLC y gateway de protocolos", Electra, , no. 143, pp. 2-7. Guolian Hou, Rui Sun, Shanshan Bi, Guoqiang Hu & Jianhua Zhang 2012, "Simulation study on scroll expander digital electro-hydraulic governing system", Control and Decision Conference (CCDC), 2012 24th Chinese, pp. 1002. Guoying Yan 2011, "The design of control system for SZ-40 injection molding machine base on PLC", Mechanic Automation and Control Engineering (MACE), 2011 Second International Conference on, pp. 7815. Harby, D., Polastri, P. & Chuenprasertsuk, C. 2007, "A new approach to teaching programable logic controller programming", ASEE Annual Conference and Exposition, Conference Proceedings. Huixiong Wan, Haibo Huang & Rui Lin 2009, "Research on all-digital strip steel rectifying electro-hydraulic control system", Mechatronics and Automation, 2009. ICMA 2009. International Conference on, pp. 498. Jia, Y. & Cheng, Y. 2012, Design of electronic control system for roller machine. Jiang, D. Fully-automatic hydraulic block forming machine for producing concrete hollow block, has upper and lower oil cylinders connected to hydraulic system by pipeline, where machine is controlled by programmable logic controller. Lewin, J. 1995, "Control of hydraulic gates", International Journal on Hydropower and Dams, vol. 2, no. 4, pp. 81-83. Li, C., Li, S. & Gao, L.
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2012, Study on novel automatic steel wire bundling machine hydraulic control system. Li, F., Ma, C., Qiang, B. & Chen, Q. 2008, "Design and development of multi-purpose hydraulic experiment platform based on PC and PLC", 2nd International Symposium on Test Automation and Instrumentation, ISTAI 2008, pp. 587. LIFENG DU, [2008, "PLC bus line connecting structure used for hydraulic press" Maldacena, C. 2005, "Operating elevators across the Americas", Elevator World, vol. 53, no. 1, pp. 116-118. A. & Cortes Osorio, J.A. 2011, "Control secuencial de un circuito electroneumático a través de un PLC.", Scientia et Technica, vol. 2, no. 48, pp. 191-195. Nachtwey, P. 2005, "Advances in digital motion control technology: Realizing the full promise of fluid power", Fluid Power Journal, vol. 12, no. 3, pp. 29-31. Naill, N., Madgwick, S., Bratten, C. & George, M. 2014, "Improving safety through logic: Programmable logic controller for conventional casing running equipment", SPE/IADC Drilling Conference, Proceedings, pp. 483 Peláez Vara, Jesús, García Maté, Esteban 2002, ?Neumática Industrial. Diseño, selección y estudio de los elementos neumáticos? ISBN 8495312000 Paluchniak, M. & Millage, B.A. 1993, "New closed loop shot control system features total integration", Die Casting Engineer, vol. 37, no. 6. Parker, J.K. & Schinstock, D. 1996, "Introduction to hydraulic and logic systems in a controls course", ASEE Annual Conference Proceedings, pp. 2063. Qiang, Z. 2012, Sliding ropes brake device of friction hoist machine design and application. QUANQUAN, L. & WEIXUE, W. 2014, "Hydraulic broaching machine based on PLC (programmable logic controller) control and used for broaching inner groove of impeller", Srinivas, R.M. & Rajagopal, V. 2009, Industrial Automation using Programmable Logic Controller, . Stott, J.G. & Wilkins, B. 2002, "Electro-hydraulic system for extrusion presses - Low energy, reliable", Aluminium Today, vol. 14, no. 3, pp. 19-20. Tremosa, L. 1999, "Sistemas neumáticos e hidráulicos: el control como protagonista", Automática e instrumentación, no. 298, pp. 61-65. Wang, J. & Deng, X. 2013, The design of rolling mills' automatic control system based on PLC. Wang, J., Zhang, D., Li, J. & Niu, W. 2001, "Hydraulic roll gap control system of plate mill and its development in PLC", Dongbei Daxue Xuebao/Journal of Northeastern University, vol. 22, no. 4, pp. 435-438. Wang, J. & Deng, X. 2013, "The Design of Rolling Mills' Automatic Control System Based On PLC", Digital Design and Manufacturing Technology Iii, vol. 546, pp. 25-29. Wang, L.H. & Wu, X.Q. 2014, The design of control system of piston pin punching recess automatic drilling dedicated machine tool. WANG, X. 2011, "PLC (Programmable Logic Controller) control system of crawler-type full-hydraulic multi-directional traveling forklift" . WANG, Y.A.O. 2013, "Control device of hydraulic quenching machine based on PLC", . Wang, Y.T. & Zhou, X. 2014, Research on control program design of variable speed hydraulic system. Yu, J. & Wang, H. 2014, "The implement of hydraulic control system for large-scale railway maintenance equipment based on PLC", Sensors and Transducers, vol. 170, no. 5, pp. 222-226. Zaeh, M.F., Poernbacher, C. & Milberg, J. 2005, "A model-based method to develop PLC software for machine tools", CIRP Annals - Manufacturing Technology, vol. 54, no. 1, pp. 371-374. Zangirolami, M. Programmable sequence controller for e.g. solar powered system. ZHENG, H. 2011, "PLC drive controller of electro-hydraulic proportional valve". Zhenhe Wang & Shaocong Guo 2009, "Research on Maintenance Optimization for Steam Turbine Digital Electro-Hydraulic Control System", Intelligent Information Technology Application, 2009. IITA 2009. Third International Symposium on, pp. 345. ZHIHUA, L. 2014, "PLC multipoint synchronous jacking-up hydraulic system". ZHIHUA, L. 2013, "Programmable logic controller (PLC) multi-point synchronization jacking up hydraulic system".



Complementary	
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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 realízalos en papel: - Non se empregarán plásticos - Realizaranse impresións a dobre cara. - Empregarase papel reciclado. - Evitarase a impresión de borradores.

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