UNIVERSIDADE DA CORUÑA

Teaching Guide				
Identifying Data				2015/16
Subject (*)	INSTRUMENTACIÓN E AUTOMATIZACIÓN DO BUQUE		Code	730G02156
Study programme	Grao en Enxeñaría en Propulsión e Servizos do Buque			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	1st four-month period	Fourth	Optativa	4.5
Language	SpanishGalicianEnglish			
Teaching method	Face-to-face			
Prerequisites				
Department	Enxeñaría Industrial			
Coordinador	Gonzalez Filgueira, Gerardo	E-mail	gerardo.gonzalez@udc.es	
Lecturers	Gonzalez Filgueira, Gerardo	E-mail	gerardo.gonzalez@udc.es	
Web	campusvirtual.udc.es/moodle/			
General description	The objective of the course is to provide future engineers in Propulsion and Ship Services knowledge necessary for the study and development of the systems used in instrumentation, automation and control of ships. Also aims to: - Use software for design and simulation of automatic tools. - Ask the wired and programmed automation of sequential systems. - Develop automation of various plants available in laboratories, using PLCs. At the end of the course students will be able to: - Raising the general structure of an automated system with different technologies and common equipment. - Write simple control logic combinational and sequential systems functions. - Analyze the operation of automatic electrical wiring diagrams, hydraulic and pneumatic. - Perform simple circuits and electro-pneumatic. - Describe the structure and operation of programmable controllers (PLCs). - Design and develop control programs with PLCs. - Exhibit the elementary concepts of temporal analysis of continuous systems, control actions and the use of regulators. Transversal objectives: - The student will improve organization of working time (for the imposition of tasks with deadlines and requirements) and autonomous learning (for handling various tools and sources of information).			

Study programme competences / results	
Code	Study programme competences / results
A1	Capacidade para a resolución dos problemas matemáticos que poidan formularse na enxeñaría. Aptitude para aplicar os coñecementos sobre: álxebra lineal; xeometría; xeometría diferencial; cálculo diferencial e integral; ecuacións diferenciais e en derivadas parciais; métodos numéricos; algorítmica numérica; estatística e optimización.
A2	Comprensión e dominio dos conceptos básicos sobre as leis xerais da mecánica, termodinámica, campos e ondas e electromagnetismo e a súa aplicación para a resolución de problemas propios da enxeñaría.
A4	Capacidade para comprender e aplicar os principios de coñecementos básicos da química xeral, química orgánica e inorgánica e as súas aplicacións na enxeñaría.
A7	Coñecemento dos conceptos fundamentais da mecánica de fluídos e da súa aplicación ás carenas de buques e artefactos, e ás máquinas, equipos e sistemas navais.
A9	Coñecemento da teoría de circuítos e das características de maquínalas eléctricas e capacidade para realizar cálculos de sistemas nos que interveñan os devanditos elementos.
A10	Coñecemento da teoría de automatismos e métodos de control e da súa aplicación a bordo.
A11	Coñecemento das características dos compoñentes e sistemas electrónicos e da súa aplicación a bordo.
A15	Coñecemento das características dos sistemas de propulsión naval.
A16	Capacidade para a realización do cálculo e control de vibracións e ruídos a bordo de buques e artefactos.

A17	Coñecemento dos sistemas para avaliación da calidade, e da normativa e medios relativos á seguridade e protección ambiental.
A20	Coñecemento dos equipos e sistemas auxiliares navais.
A21	Coñecemento das máquinas eléctricas e dos sistemas eléctricos navais.
A22	Capacidade para proxectar sistemas hidráulicos e pneumáticos.
A23	Coñecemento dos métodos de proxecto dos sistemas de propulsión naval.
A24	Coñecemento dos métodos de proxecto dos sistemas auxiliares dos buques e artefactos.
A26	Coñecemento dos procesos de montaxe a bordo de máquinas equipos e sistemas.
A27	Coñecemento dos fundamentos do tráfico marítimo para a súa aplicación á selección e montaxe dos medios de carga e descarga do buque.
A29	Coñecementos de sistemas de control a bordo do buque.
A30	Optimización de rendemento de equipos navais e máquinas auxiliares.
A32	Coñecementos de sistemas de instrumentación mariña.
A33	Coñecementos de sistemas de adquisición de datos para o control a bordo do buque.
A35	Capacidade de selección de sistemas de captación e xeración de enerxía a partir do potencial enerxético marítimo da ondas, vento, mareas, etc. que sexan os máis adecuados segundo as características da enerxía a aproveitar e do lugar.
A38	Capacidade para realizar un proxecto de instalación e montaxe das instalacións de produción de enerxías renovables mariñas, incluída os seus equipos e previsión do mantemento e potenciais reparacións a realizar.
A42	Capacidade de selección de equipos e compoñentes para os devanditos sistemas.
A43	Capacidade de dirección, coordinación e participación nos traballos de montaxe, probas e reparacións dos devanditos equipos e sistemas específicos en buques e plataformas petrolíferas de perforación e produción durante a súa construción.
A44	Capacidade de selección de equipos para control de posición de buques e plataformas petrolíferas móbiles.
A46	Capacidade de dirección, coordinación e participación nos traballos de montaxe, probas e reparacións dos devanditos equipos nos buques e plataformas durante a súa construción no estaleiro.
A52	Colaborar en equipo.
A53	Coñecemento básico da hidrostática e a hidrodinámica naval.
B1	Aprender a aprender.
B2	Resolver problemas de forma efectiva.
B3	Aplicar un pensamento crítico, lóxico e creativo.
B4	Traballar de forma autónoma con iniciativa.
B5	Comportase con ética e responsabilidade social como cidadán e como profesional.
B6	Comunicarse de xeito efectivo nun ámbito de traballo.
B7	Actitude orientada ao traballo persoal intenso.
B9	Actitude orientada á análise.
B10	Actitude creativa.
B11	Capacidade para encontrar e manexar a información.
B12	Capacidade de comunicación oral e escrita.
B13	Manexo de sistemas asistidos por ordenador.
B14	Concepción espacial.
B16	Analizar e descompoñer procesos.
B17	Capacidade de abstracción, comprensión e simplificación de problemas complexos.
B18	Motivar ao grupo de traballo.
C1	Expresarse correctamente, tanto de forma oral coma escrita, nas linguas oficiais da comunidade autónoma.
C2	Dominar a expresión e a comprensión de forma oral e escrita dun idioma estranxeiro.
C3	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.
C4	Desenvolverse para o exercicio dunha cidadanía aberta, culta, crítica, comprometida, democrática e solidaria, capaz de analizar a realidade, diagnosticar problemas, formular e implantar solucións baseadas no coñecemento e orientadas ao ben común.
C6	Valorar criticamente o coñecemento, a tecnoloxía e a información dispoñible para resolver os problemas cos que deben enfrontarse.
C7	Asumir como profesional e cidadán a importancia da aprendizaxe ao longo da vida.

C8	Valorar a importancia que ten a investigación, a innovación e o desenvolvemento tecnolóxico no avance socioeconómico e cultural da sociedade.

Learning outcomes			
Learning outcomes	Study programme competences / results		
The aim of the course is to introduce students to the design of sequential control systems applied to different branches of engineering concepts and principles of Control and Automation, types of control systems are discussed. Scheduling hard-wired systems. Sequential design systems. Synthesis of sequential systems automata. Industrial Robotics. It is therefore intended to provide a very estimable basis for the development of applications in various fields of engineering as they can be: - Programming of systems of regulation and control. - Design of Logic Systems Wired. - System Design Programmed Logic. - Programming of PLCs. - Advanced Automation. - Programming of machine tools. - Using Neural Networks for Robotic applications. - Application programming for robotics. - Electronic Design Digital Systems. - Programming of finite automata. - Systems Design oleo. - Analysis and Simulation of Electrical / Electronic Systems and Control.	A1 A2 A4 A7 A9 A10 A11 A15 A16 A17 A20 A21 A22 A23 A24 A26 A27 A29 A30 A32 A33 A35 A38 A42 A43 A44 A46 A52 A53	B1 B2 B3 B4 B5 B6 B7 B9 B10 B11 B12 B13 B14 B16 B17 B18	C1 C2 C3 C4 C6 C7 C8

Contents	
Topic	Sub-topic
1. Introduction to measurement and control systems.	1.1. Introduction. Aims. 1.2. Systems of measure and control. Keywords. 1.3. Concept of Automation. 1.4. Ways operation of a plant. 1.5. Elements of a System of Automation. 1.6. Aims of the Automation. 1.7. Elements of a system of control. 1.8. Types of signals in a system of control. 1.9. Classification of the automatisms. 1.10. Phases in the Design of a System of Automation 1.11. Implantation of the system of control.

2. Sensors and actuators.	2.1. Introduction. 2.2. Types of sensors. 2.3. Classification actuators/drives
3. Instrumentation on board the vessel.	3.1. Introduction. Measuring instruments on the ship. 3.2. Anemometer. Veleta. Wind Instrumentation 3.3. Sliding probe. Sounder. 3.4. Depth Sounder. 3.5. Temperature Probe. 3.6. GPS. Plotter 3.7. Autopilot. 3.8. Inductive sensors marine. 3.9. RPM.
4. Introduction to programmable logic controller (PLC) in the vessel.	4.1. PLC Hardware. 4.2. Software PLC. 4.3. Interaction between PLC and Real World. 4.4. Programming the PLC to control the plant. 4.5. Basic types of data (variables) in a PLC. 4.6. Programming in Ladder Diagram. 4.7. List programming instructions. 4.8. AND function. 4.9. Función OR. 4.10. Función XOR. 4.11. Organización básica de un programa. 4.12. Ejemplo simple de automatización con PLC. 4.13. Diseño de un Sistema de Automatización con lógica Programada. 4.14. Sociedades de Clasificación y autómatas programables. 4.15 Normativa IEC-1131.
5 Methodology for designing systems sequences. SFC	5.1. Introduction SFC. 5.2. Division into stages or phases. 5.3 Graphical symbols Grafcet. 5.4. Grafcet evolution rules. 5.5. Basic structures of the SFC. 5.6. Design and implementation. 5.7. Useful guidance for the implementation: Set / Reset. 5.8. Refinement: Ensure system shutdown. 5.9. Relationship between SFC and implementation in PLC. 5.10. Equivalence between PLC and digital implementation. 5.11. Edge detection signal (FP / FN). 5.12. Reset operation or initialization. 5.13 Sequence of operation of a system.
6. PLC and its environment: Wireless tires, hydraulic systems and electric.	6.1. Introduction Communication protocols on the ship. 6.2. NMEA protocol. 6.3. SeaTalk protocol. 6.4. RS-232 protocol. 6.4. RS-422 protocol. 6.5. RS-485 Protocol 6.5. Hydraulic system. 6.6. Electrical Systems.

7. Integration of Automatic Systems Vessel	7.1. Communication networks in the Vessel. 7.2. Introduction to communication networks. 7.3. Regulations for local area networks. 7.4. General characteristics of the Ethernet network 7.5. The PLC communication networks 7.6. PLC functions in a communication network. 7.7. Communications networks PLCs
8. Process monitoring systems	8.1. Communication networks and monitoring systems 8.2. Control and data acquisition. 8.3. Elements of a SCADA. 8.4. Application examples.
9. Basic Alarm Systems in Vessels Features.	9.1. Regulations on the basic features of Alarm Systems 9.2. Management and Supervision automatic alarms.

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Introductory activities	A1 A4 A20 A23 A24 A29 B10 B11 B12	0.1	0	0.1
Guest lecture / keynote speech	A2 A7 A9 A10 A11 A15 A17 A21 A26 A27 A30 A32 A33 A35 A42 A44 A53 B3 B6	18	20	38
Case study	A16 A22	12	12	24
ICT practicals	A1 A10 B4 C3	0	3	3
Laboratory practice	A1 A4 A7 A9 A10 A11 A15 A16 A22 A35 A42 B4 B9	6	12	18
Supervised projects	A1 A2 A4 A7 A9 A10 A11 A15 A38 A42 A43 A44 A46 A52 B14 B13 B7 B5 B4 B3 B2 B1 B16 B17 B18 C1 C2 C3 C4 C6 C7	6	12	18
Oral presentation	A10 A23 A24 A26 A29 A32 A33 A42 A52 B2 B4 B5 B7 C1 C2	0.2	0.2	0.4
Research (Research project)	A7 A9 A10 A16 A20 A21 A26 A27 A29 A32 A33 B1 B2 B3 B4 B5 B6 B7 B9 C1 C2 C3 C8	3	3	6
Events academic / information	B1 B2 B3 B4 B5 B6 B7 B9 C1 C2 C3 C8	1.5	1.5	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	It consists of the presentation by the teacher the most relevant applications in industry that are subject to programming in the course.
Guest lecture / keynote speech	It consists of an oral presentation complemented by the use of media and the introduction of some questions to the students, in order to impart knowledge and facilitate learning. The explanations given in the lectures on the Board, are supported with the use of transparencies, and applying the knowledge gained to specific examples. All topics of the course have a set of specific tasks that develop in practical classes. Sequences targeted small dialogues. Troubleshooting common questions. Face classroom activity that serves to establish the fundamental concepts of the subject.
Case study	Problems arising in the field of design of industrial control systems and possible solutions through group discussion.
ICT practicals	We propose the use of the Virtual Platform for diposición various materials for monitoring the course: Transparencies for the agenda, Statements Exercising manuals Automation, Supplementary Material as links, videos of Industrial Control Systems, etc.. Also you can download files containing exercises Industrial Security Control Design Control to advance the establishment of concepts by students.
Laboratory practice	Development practices in the laboratory. This will consist of case studies and examples are also performed, by the students, exercise design automation systems and programmable logic wired logic. In attempting Programming practices that each student can follow their own pace, for which manuals are provided with the necessary programming explanations, worked examples and set of exercises of increasing difficulty. A set of practices weekly duration equal to-face lectures is established. The execution support of such practices is mandatory. The recommended reading level is appropriate to the subject and can be used to extend or clarify parts of the program.
Supervised projects	Throughout the course of carrying volunteers supervised works are proposed by teachers. At the end of the relevant semester students who have opted for execution of said work must necessarily expose the contents thereof, forming part of an exposure assessment test. There are two alternatives for conducting supervised works: a) As the school year progresses and develops at different levels of programming a List of Basic supervised works are proposed. These works consist of a set of theoretical issues and practical exercises for the student to assess the ability to understand the foreground. Depending on the difficulty of the theme of this work may be done individually or in pairs. b) Alternatively students can do on Advanced Aspects supervised works on a topic related to Programming Industrial Process Control, the application of computers in industry, industrial process control, or other areas of industrial programming. These volunteers work any student may request them, or by performing a particular teacher or accepting a proposal of this proposal. The content of this work must be previously agreed with the teachers of the subject. The acceptance or rejection of a student to perform volunteer work is entirely discretionary on the part of the teacher. This is to ensure a minimum quality in the mentioned works. The student must submit a work plan that includes objectives, methodology and implementation period.
Oral presentation	Students who have opted-out of the proposed Tutored throughout the course must necessarily expose the contents thereof, forming part of the exhibition overall evaluation of the course. Quality of content, mastery of subject matter, clarity of exposition and means used for the same will be appreciated.
Research (Research project)	Upon completion of the modules of theory and practical work certain voluntary organization that provide real industrial scheduling systems that are in many cases the prologue of performing FINAL DEGREE PROJECTS proposed
Events academic / information	As a means of research activities initiated in small voluntary work completion for those students who wish to complete their education or start in the programming techniques of advanced automation systems.

Personalized attention	
Methodologies	Description

Guest lecture / keynote speech Laboratory practice Supervised projects Oral presentation Research (Research project) Introductory activities ICT practicals Case study	All methodologies contain care tutored by the teacher in tutoring schedule is published each year in the central planks. In addition, features tutorials through the Virtual Platform. Keynote Session: Resolving conceptual doubts. Case Study: Resolution of doubts arising problems in the design field of industrial control systems and possible solutions through a group discussion from different perspectives. Practice Lab: Resolving conceptual doubts. Tutored Work: Resolving conceptual doubts. Tracking execution of work. Research (Research Project): Project Implementation Monitoring End of career and work. Oral presentation: Writing Help for exposure. Initial activities: Submit the subject and his Redeemer naval industrial and utility landscape.

Assessment			
Methodologies	Competencies / Results	Description	Qualification
Laboratory practice	A1 A4 A7 A9 A10 A11 A15 A16 A22 A35 A42 B4 B9	Compulsory Attendance. 20% of unexcused absences involves qualification of the subject NO PRESENTED.	10
Supervised projects	A1 A2 A4 A7 A9 A10 A11 A15 A38 A42 A43 A44 A46 A52 B14 B13 B7 B5 B4 B3 B2 B1 B16 B17 B18 C1 C2 C3 C4 C6 C7	Quality work. Appropriateness to the objectives. Content. Originality. Clarity in the same exhibition.	50
Oral presentation	A10 A23 A24 A26 A29 A32 A33 A42 A52 B2 B4 B5 B7 C1 C2	Conciseness and clarity of presentation. Domain content.	10
Research (Research project)	A7 A9 A10 A16 A20 A21 A26 A27 A29 A32 A33 B1 B2 B3 B4 B5 B6 B7 B9 C1 C2 C3 C8	Scientific Interest. Originality.	10
ICT practicals	A1 A10 B4 C3	Realisation of exercises of Design of Systems of Industrial Control.	5
Events academic / information	B1 B2 B3 B4 B5 B6 B7 B9 C1 C2 C3 C8	Presentation of representative summaries of the events. Participation in the final talks of the events.	5
Case study	A16 A22	It values the ideonidad of the solution posed to the problems in the field of the design of the systems of industrial control.	10

Assessment comments

OBSERVATIONS:The methodology employed is the system of continuous evaluation. Anyway the student will have right, if like this it wished it, to be examined by means of objective proof at the end of the cuatrimestre by all the theoretical part-practical of the contents of the asignatura
Those students that opt by the system of continuous evaluation, the assistance to CLASSES will be a compulsory requirement to approve the asignatura. Those students that surpass 20% of faults of assistance will have the qualification of NO PRESENTED in the Asignatura. For the superación of the matter the student will resolve a group of problems and exercises proposed along the course. Besides, like colophon to the learning purchased, realised Works Tutorizados of end of course like a part more than the method of continuous evaluation. The realisation of Works Tutorizados will have to expose the content of the same at the end of the period lectivo corresponding, forming said exhibition splits of the proof of evaluation. They exist two alternatives for the realisation of Works Tutorizados:
To) they will propose a List of Works Tutorizados Basic. Said works consist in a Group of Questions and theoretical Exercises-practical so that the student value the capacity of understanding of the knowledges purchased. Depending on the difficulty of the subject chosen this work will be able to be realised individually or by couples.
b) Alternatively the students will be able to realise Works Tutorizados in Appearances Advanced on a subject related with Programming of Processes of Industrial Control, the application of the computers in the industry, control of industrial processes, or other areas of industrial programming. These voluntary works will be able to request them any student, well realising a concrete proposal to the professor or accepting a proposal of this. The content of this work will have to be consensuado previously with the profesorado of the asignatura. The acceptance or no of a student for the realisation of a voluntary work is totally discretionary by part of the professor. With this pretends guarantee a minimum of quality in the quoted works. The student will have to deliver a plan of work that include Aims, Methodology and term of realisation. The ponderación of the works tutelados will be able to suffer a modification by means of the application of a parameter S, parameter of Satisfaction, that is a parameter of value comprised between 0 and 3. The value of said parameter determines as follows and will update at the beginning of each course. The first year in that it gives a degree the parameter S has the value 1. The following years the parameter S calculates of linear proportional form to the degree of satisfaction by part of the student with the system of evaluation used in the asignatura. Said parameter will have a minimum value of 1 and maximum of 3 when in the surveys of evaluation that realise the students, in those points that are notable for the accreditation of the profesorado (in the actuality the point 24:%or201DGlobalmente am satisfied with the professor of this matter%or201D), obtain a qualification between 5 and 7 respectively. Assessments comprised between 1 and 5 will correspond with values of the parameter between 0 and 1. The punctuation obtained by the professor of the asignatura in the last surveys with available results will be the indicativos with which elaborate the parameter S.
The preparation, tutorización, control and correcciónde works tutelados, as well as the control individualizado of assistances, of the answers in the classes and of the work of the student in general, supposes an additional load of work and dedication for the professor that earns only felt when the alumnado recognises it and values it. For this reason, it uses the parameter S in the system of qualification. Of this form enters a realimentación in the system of qualification that does that these additional mechanisms of evaluation purchase a weight in the final qualification that was function of the satisfaction of the student with the system of evaluation used. Ideally, this parameter would have to affect to the students that evaluate the system in each academic course. However the mechanism of realisation and evaluation of surveys that uses in this university does that this was unfeasible, by which are the students of a course those that influence in the system of qualification of the students of the following course. This is not an ideal procedure, but is the only viable, and does not generate a big distortion in the system, if it takes into account that the formative differences and the distinct sociological conditionings that they can influence in the evaluation given by the students of a course in the surveys, do not differ grandemente of the ones of the students of the following course. It suits besides take into account that, whereas the profesorado evaluates to the students of objective way, and these enjoy of a group of rights of control and claim of the qualifications, being able to at all times be informed of who and how evaluates them, the professor in this university, is evaluated by means of a question in an anonymous survey, of form entirely subjective and without that they exist objective parameters of evaluation, as well as without that it can know who evaluates and how, so that they could exercise by part of the profesorado the rights of control and claim that would have to have in a so important question. With the utilisation of this coefficient of qualification does him conscious to the student that by means of his evaluation of the exert of the professor influences in a direct way and objetivable in the work of the same.
Global qualification final:
The qualification, C.G., of the asignatura composes of the following parts:
To) A theoretical part-practical corresponding to the Study of cases, EC (10%). The resolutions of problems posed will have to present like TERM LIMIT the date of ending of the subject of the corresponding content.
b) A practical part, PTIC (5%), corresponding to the memories presented of the Practices through TIC . The memories will be able to present like TERM LIMIT the corresponding date to the ordinary announcement of January of the asignatura.
c) A practical part, PL (10%), corresponding to the memories presented of the Practices of Laboratory. The memories will be able to present like TERM LIMIT the corresponding date to the ordinary announcement of February of the asignatura.
d) A corresponding practical part to the Works Tutelados, TT (50%). The realisation of said works has caracter voluntary. The memories and exhibition

of the works tutelados will be able to present like TERM LIMIT the corresponding date to the ordinary announcement of February of the asignatura.
The ponderación of the works tutelados will be able to suffer a modification by means of the application of a parameter P that it is a parameter of value comprised between 0 and 3. The value of the parameter P determines as follows. The first year in that mparte a degree the parameter P has the value 1. The following years the parameter P calculates of proportional form to the degree of satisfaction by part of the student with the system of evaluation used in the asignatura. Said parameter will have a minimum value of 1 and maximum of 3 when in the surveys of evaluation that realise the students, in those points that are notable for the accreditation of the profesorado (in the actuality the point 24:%or201DGlobalmente am satisfied with the professor of this matter%or201D), obtain a qualification between 5 and 7 respectively. Assessments comprised between 1 and 5 will correspond with values of the parameter between 0 and 1. The punctuation obtained by the professor of the asignatura in the last surveys with available results will be the indicativos with which elaborate the parameter P.
The preparation, tutorización, control and correcciónde works tutelados, as well as the control individualizado of assistances, of the answers in the classes and of the work of the student in general, supposes an additional load of work and dedication parael professor that earns only felt when the alumnado recognises it and values it. For this reason, it uses the parameter S in the system of qualification. Of this form enters a realimentación in the system of qualification that does that these additional mechanisms of evaluation purchase a weight in the final qualification that was function of the satisfaction of the student with the system of evaluation used. Ideally, this parameter would have to affect to the students that evaluate the system in each academic course. However the mechanism of realisation and evaluation of surveys that uses in this university does that this was unfeasible, by which are the students of a course those that influence in the system of qualification of the students of the following course. This is not an ideal procedure, but is the only viable, and does not generate a big distortion in the system, if it takes into account that the formative differences and the distinct sociological conditionings that they can influence in the evaluation given by the students of a course in the surveys, do not differ grandemente of the ones of the students of the following course.
And) oral Presentation of the works tutelados PO (10%).
f) Oral proof PRO (10%).
g) A corresponding practical part Project of investigation PI(10%).
h) A corresponding practical part to Events and Projects of Investigation, EPI (5%). The assistance to events and realisation of Projects of investigation will have caracter vountario.
Each one of the individual parts evaluated like "APT" (qualification > or = 5) they will conserve until the Announcement of July of the current course. Never they will conserve for the following courses.
The final qualification of the asignatura will be the sum average of the qualifications obtained in all the parts:
C.G.=0.1*EC 0,05*PTIC 0,1*PL 0,5*TT 0,1*PO 0,1*PRO 0,1*PI 0,05*EPI
Once fulfilled the previous requirements, the realisation, by part of the alumnado, of projects of investigation will have caracter voluntary and will be able to suppose an increase between a 2 and a maximum of 25% of the global qualification final, with the legal limit established of 10 points máximo.en this case, the final Note will be:
FINAL QUALIFICATION=min (C.G, 10)
The qualification of the subject, in accordance with the R.D. 1125/2003 of 5 September (B.Or.And. Of the 18.9.2003) it comes expressed according to a numerical scale of 0 to 10, with expression of a decimal. The subject passes with a global qualification (C.G.) Of 5 points on 10.
Note:1. The provisional qualifications of each announcement will publish in the virtual Platform Moodle and will send through SMS, if the student previously has authorised his sending. In any one of the cases the definite qualifications that appear in the records, which the student can consult in the office of the centre, are the legally valid.
2. It will not describe to the students that do not appear in the records of the asignatura until to regularize his situation in the administration of the centre.

Sources of information	
Basic	- Creus Solé, A. (1997). Instrumentación Industrial. Marcombo - Gerardo González Filgueira. César A. Vidal Feal. (2005). Autómatas Programables. Programación y Entorno.. Ramón Cabanillas 8, 1F. 15071. Santiago de Compostela (A Coruña). España. Reprografía Noroeste, S.L - Enrique Mandado (2005). Autómatas Programables. Entorno y Aplicaciones.. Thomson-Paraninfo. - Dante Jorge Dorantes (2004). Automatización y Control. Prácticas de Laboratorio.. Mac Graw-Hill - Taylor D.A. (2003). Introduction to Marine Engineering. Elsevier - Balcells J., Romeral J.L. (1997). Autómatas Programables. Marcombo - SMC International Training (2002). Neumática. Thomson Paraninfo - Piedrafita Moreno, R. (1999). Ingeniería de la automatización industrial. RA-MA
Complementary	- Florencio Jesús Cembranos Nistal. (1998). Sistemas de control Secuencial.. Thomson-Paraninfo - Ogata, K. (1998). Ingeniería de Control Moderna. Prentice-Hall

Recommendations
Subjects that it is recommended to have taken before
ÁLXEBRA/730G02106 ECUACIÓNS DIFERENCIAIS/730G02110 AUTOMATISMOS. CONTROL E ELECTRÓNICA/730G02116
Subjects that are recommended to be taken simultaneously
CONTROL E REGULACIÓN DE MÁQUINAS NAVAIS/730G02153
Subjects that continue the syllabus
Other comments

(*)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.