UNIVERSIDADE DA CORUÑA

Teaching Guide				
Identifying Data				2020/21
Subject (*)	Industrial Maintenance Engineering		Code	770G02137
Study programme	Grao en Enxeñaría Eléctrica			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	2nd four-month period	Fourth	Optional	4.5
Language	Spanish			
Teaching method	Face-to-face			
Prerequisites				
Department	Enxeñaría Industrial			
Coordinador	Castilla Pascual, Consuelo de los L.	E-mail	consuelo.castilla.pascual@udc.es	
Lecturers	Castilla Pascual, Consuelo de los L.	E-mail	consuelo.castilla.pascual@udc.es	
Web	www.moodle.udc.es			
General description	It treats of one asignatura that has a crácter fundamentally technological. The industrial maintenance constitutes an essential activity to reach high degrees of efficiency in the productive systems of the company and like this guarantee the competitive advantage so much in the products as in the services offered. The student will purchase the capacity of management of the information, handle and application of the technical specifications and the legislation, necessary in the area of the maintenance.			

Contingency plan	1. Modifications of the contents - Non will realise changes 2. Methodologies *educational Methodologies that keep - Session magistral (computes in the evaluation 10%, by regular and active assistance, will compute if there is it in his 80% while it give presencialmente and in case to have to give no presencialmente, by the active participation in the thematic questionnaires and his forums, in 60% of the same) - objective Proof (computes in the evaluation 40%, to realise in the official announcement, always voluntary will allow, his addend with his already applied weight, go up the note if it reaches the approved in the sum of the weights of the others methodologies, will allow to go up the note) - Solution of problems (computes in the evaluation 30%) (with personalised Attention). They will see problems mainly of calculation of indicators and taxes employed in maintenance, without involving simulation or modelling by his fault of complexity; realised varied of them in the sessions, will open in Moodle the asynchronous delivery of similar problems, distributing the weight of 30% by the same between all the activities of problems in Moodle. - Practical of laboratory (computes in the evaluation 20%) (with personalised Attention). They will see cases of simulation, some for example in Excel, proposing similar cases to the seen in the sessions of the methodology, to go up in asynchronous activity of Moodle and also is foreseen the final realisation of a technical visit to company with management of computer-aided maintenance. His mechanics, with regard to the cases of simulation, employee in the face-to-face teaching, will keep in the no face-to-face teaching: the professor will open in Moodle the asynchronous activities of cases to simulate, similar to the exposed in the sessions of practices (already are face-to-face or in Teams), for the members of the small group. It is in the case to require the no face-to-face teaching at the end of cuatrimestre, when it will produce the only change: the impossibility to realise the technical visit. *Educational methodologies that modify Practices of laboratory (computes in the evaluation 20%) (with personalised Attention). In the no face-to-face model will not be able to realise the planned technical visit final and delivery of his memory, in said case will distribute the weight of 20% by the same between all the activities of practices that open in Moodle for the delivery of practical cases. 3. Mechanisms of personalised attention to the alumnado - Email: twice to the week in the schedule of tutorías established at the beginning of the cuatrimestre by the professor, so that the student that require it realise queries of tutorías or, if his doubt the precise, agree virtual meeting in Teams. The professor also can require to a concrete student that attend to session of tutoría. - Questionnaires in Moodle Thematic and forum the back day to the questionnaire: when finishing a pair of subjects, treated in Teams in the corresponding to the weekly time band according to the programming of the schedule of the centre, will open a questionnaire in Moodle for a better follow-up of the advance of the student in the matter, will be active during a day, and the next day will open in Moodle, for the personalised attention, a forum of discussion with regard to those questions whose solutions that caused them doubt when realising the questionnaire. Questionnaire and forum, after opening , will be available for all the students of big group during a week. - Sessions in Teams, of Session Magistral, of Problems and Practical, to realise in in the time band established in the calendar-time of the EUP for the asignatura. The one of Session Magistral in big group, weekly, is for the advance of the theoretical contents of the matter, the one of Problems in average group for the advance in problems, and will realise weekly in the same time band that the one of practices. intercalan Between if sessions of problems with sessions of practices, the ones of practices of simulation are to help to the students in the know do practical of the maintenance, by means of the exhibition of examples of simulation that orient them in the preparation of the deliveries of asynchronous practical activities that open in Moodle. 4. Modifications in the evaluation - Practical of laboratory (computes in the evaluation 20%) (with personalised Attention). In the face-to-face modality, comprises: resolution of cases and technical visit, where, the assessment of the memory of the visit will be under the

weight of 20%, as long as it have assisted to all the sessions of practices and low, the also, condition to having delivered all and each one the cases of simulation proposed and have correct minimum 50% of the group of the practical activities.

- Practical of laboratory (computes in the evaluation 20%) (with personalised Attention). In the no face-to-face modality, will comprise alone cases of simulation (greater number of them), in said case the weight of 20% of the methodology will deliver by the same between the cases of simulation that have proposed like asynchronous activities in Moodle, requiring like condition have assisted of regular form to the sessions in Teams, that have realised minimum 80% of the practical activities and that are correct minimum 60% of the realised.

* Observations of evaluation
- The control of assistance only will realise with regard to the sessions in which there is presencialidad and until the moment in that it suspend the face-to-face activity.
- The objective proofs official (first and second opportunity), will realise in synchronous session of Teams according to the calendar of examinations that establish the centre, at the same time that it will open the proof in Moodle: it will increase him the time in 50% of the indicated in the guide of the matter, to take into account the half of the proof in Moodle (digital format) and have to go up escaneos or photos of the justifications to fist and letter of the problems that include.

1. SITUATIONS:

To) Alumnado with complete dedication:
- minimum Assistance of 80% in classes of big and average groups and minimum participation of 80% of his activities.
- Assistance of 100% in classes of small groups and realisation of 100% of his activities.
B) Alumnado With dedication part time and dispenses academician of exemption of assistance:
- minimum Assistance of 80% in classes of big and average groups and minimum participation of 80% of his activities.
- Assistance of 100% in classes of small groups and realisation of 100% of his activities.

2. REQUIREMENTS TO SURPASS THE MATTER:

- Assist and participate regularly.
- Deliveries of activities in Moodle (80% of problems and 100% of practices) before the limit of time established.
- That the addends with weights applied of the methodologies cursadas allow to obtain a punctuation of 5 points and have obtained in the methodology of practices, with the weight the applied an addend of minimum 1 point (the maximum is 2).
- The criteria of evaluation in first and second opportunity are the same.
5. Modifications of the bibliography or webgrafía
do not realise changes, but facilitates the following listing for access to the version in electronic book:

García Garrido, Santiago. The contracting of the industrial maintenance : processes of externalización, agreements and companies of maintenance / Santiago García Garrido. [Madrid] : Díaz of Santos, 2012 Access: http://kmelot.biblioteca.udc.es/record=b1695444S1*gag

García Garrido, Santiago. Organizacion And gestion integral of maintenance : practical manual for the implantation of systems of gestion advanced of industrial maintenance / Santiago Garcia Garrido. Madrid : Diaz of Santos, c2004 Access: http://kmelot.biblioteca.udc.es/record=b1561171S1*gag

Norma JOINS-IN 13269:2007 Maintenance Consult in AENORmás
Norma JOINS-IN 13306:2011 Terminology of the maintenance Consult in AENORmás

Study programme competences / results	
Code	Study programme competences / results
A4	Capacidade de xestión da información, manexo e aplicación das especificacións técnicas e da lexislación necesarias no exercicio da profesión.
B1	Capacidade de resolver problemas con iniciativa, toma de decisións, creatividade e razoamento crítico.
B2	Capacidade de comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial.
B3	Capacidade de traballar nun contorno multilingüe e multidisciplinar.
B4	Capacidade de traballar e aprender de forma autónoma e con iniciativa.
B5	Capacidade para empregar as técnicas, habilidades e ferramentas da enxeñaría necesarias para a práctica desta.
B9	CB2 - Que los estudiantes sepan aplicar sus conocimientos a su trabajo o vocación de una forma profesional y posean las competencias que suelen demostrarse por medio de la elaboración y defensa de argumentos y la resolución de problemas dentro de su área de estudio.
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.

Learning outcomes			
Learning outcomes	Study programme competences / results		
It applies the technicians of the maintenance of an Industrial installation	A4	B1 B2 B3 B4 B5 B9	C3
It can carry out the distinct types of maintenance: electrical, electronic and mechanic.	A4	B1 B2 B3 B4 B5 B9	C3
It applies the concepts of reliability inside the maintenance.	A4	B1 B2 B3 B4 B5 B9	C3
It is able to interpret the technical information and other sources of information, in spanish and english.	A4	B1 B2 B3 B4 B5 B9	C3

Contents	
Topic	Sub-topic
SUBJECT I. KNOWLEDGE OF THE MATERIAL. (Content: industrial Maintenance)	- Nature and classification of the material: Material of production. The peripheral material. Installations. - Inventory of the park of material: functional Division and coding. - Historical file of the machinery: The dossier-machine. Utility and exploitation of the historical.

SUBJECT II. INTRODUCTION TO THE ENGINEERING OF THE MAINTENANCE. (Content: Mantenimineto Industrial and Reliability)	- The maintenance correctivo: palliative Maintenance and curativo.0 - The preventive maintenance: Concepts and aims. Laws of degradation. - Systematic maintenance. Conditional or predictive maintenance. - The Total Productive Maintenance (TPM): Introduction and concept. - Other activities of the service of maintenance: Improvement, modernisation, renewal and reconstruction.
SUBJECT III. TYPES OF MAINTENANCE. (Content: Industrial Maintenance and special Maintenances)	- Nature and classification of the material: -The maintenance correctivo: palliative Maintenance and curative. - The preventive maintenance: Concepts and aims. Laws of degradation. - Systematic maintenance. Conditional or predictive maintenance. - The Total Productive Maintenance (TPM): Introduction and concept. - Other activities of the service of maintenance: Improvement, modernisation, renewal and reconstruction.
SUBJECT IV. MANAGEMENT OF THE INDUSTRIAL MAINTENANCE. (Content: Industrial Maintenance, special Maintenances and Reliability)	- Study of the failures, tax of failure. - Mantemento Centred na Fiabilidade (RCM). - Analysis of costs of maintenance. - Planning of the maintenance. Charts of GANT and PERT. - Computer-aided maintenance GMAO. - Collected, analysis of data and diagnose.
SUBJECT V. SPECIAL MAINTENANCES. (Contained special maintenances)	- Maintenance mechanical teams: thermography and thermometry, lubricación and vibration. - Maintenance electrical and electronic teams.
SUBJECT SAW. SPECIFIC STANDARDS ON THE MAINTENANCE. (Content: Specific standards on maintenance)	Standard UNE and disposals: - Standard UNE - EN 13306:2018 Terminology of the maintenance. - Standard UNE - EN 13269:2016 Guide for to preparation of agreements of maintenance. - - Standard UNE - EN 13460:2009. Documents for the maintenance. - Standard UNE - EN 15341:2008 Indicators of performance of maintenance. - Standard UNE - CEN/TR 15628: 2015 Qualification of the personnel of mantemiento. - Standard UNE - EN 151001:2011 Indicators of mantenibilidad of industrial devices.

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A4 B2 B3 B4 B5	12	20	32
Laboratory practice	A4 B1 B2 B4 B5 C3	7.5	18	25.5
Problem solving	A4 B1 B2 B3 B4 B5 B9 C3	12	38	50
Objective test	A4 B1 B2 B3 B4 B5	2	1	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
Guest lecture / keynote speech	- Explanation of each one of the subjects of the programming with support of presentations type powerpoint and videos, except the parts that entregen for reading. - Explanation of the operation of teams of measure used in the maintenance. - Some turns of opening debate.
Laboratory practice	Realisation of diverse practical experiences of the developed in the contents of the matter,serve to reinforce and contrast the technical knowledges purchased.

Problem solving	- They will realise problems type and questions developed by the professor, to end of clarificar the exposed concepts in the sessions magistrales. - To mark this activity will propose some problems related with the theoretical subjects that, or realised by the student in class, or will resolve by the student freely, after which will send them by moodle to the professor for his punctuation, which will reach if the development and solution are correct, as long as the deliveries are inside the term established in each one of them.
Objective test	- It will realise a proof objective at the end on of the subjects worked the long of the course.

Personalized attention	
Methodologies	**Description**
Laboratory practice Problem solving	They will realise mainly in the corresponding tutorias and in the transcurso of the class, bién to initiative of the student, or proposal of the professor. It will procure individual attention each student in the resolution of problems and in the practices, improving the initiative and the personal work of the student.

Assessment			
Methodologies	**Competencies / Results**	**Description**	**Qualification**
Laboratory practice	A4 B1 B2 B4 B5 C3	They will compute until 20% of the final note if it has 100% of assistance and presents a brief description-apt final memory. They are compulsory and his no realisation, or if realising does not reach 50% of his weight, prevents the superación of the matter.	20
Objective test	A4 B1 B2 B3 B4 B5	-Proof to realise in the corresponding official announcements and will mark with one maximum of 40% of the final note. -It is voluntary, reach or no the 5 in the sum of the contributions to final note of the reached in the others methodologies of evaluation allows to go up the note in his contribution like addend in the final note (until in 4 points). -The length of the objective proof will be of 2 hours and will consist of 20 questions of equal value, being able to be type test with one or several solutions or of short answer, where at least three will be exercises on the subjects worked along the course. - The length is expandable for the student that have conceded adaptation to the diversity that estimate % of additional time established by the service ADI of the UDC.	40
Guest lecture / keynote speech	A4 B2 B3 B4 B5	Will take into account the regular and active assistance of the student to the sessions with 10% of the final note. The assistance has to be upper to 80% of the sessions so that it compute the checkpoint like addend of the final note.	10
Problem solving	A4 B1 B2 B3 B4 B5 B9 C3	The proofs written of resolution of problems will contribute to the final punctuation with a maximum of 30% of the note reached in the group of them (correct the total of them on 10 and applies 30%). The 10 of the same will distribute by the same between the number of proofs that realise in the academic course. Owe minimum to assist to 80% of the sessions and realise 80% of his proofs.	30

Assessment comments

The final punctuation will be:
The sum of the active assistance to sessions magistrales if minimum assisted of active form to 80% of them (until 1 point), more the one of practices, having assisted to 100% and realised 100% of his activities having realised correct minimum 50% of the group, condition to be able to value the memory of the technical visit (until 2 points), and more the punctuation reached in the total of the proofs of solution of problems realised along the course, having assisted to 80% of them and realised minimum the delivery of 80% of his activities (until 3 points delivered the weight by the same between the activities of problems proposed). When the sum of these three addends do not reach the five or, reaching or surpassing, wants to go up note will have to realise the objective proof and will add his punctuation on ten affected by the forty by one hundred, and thus, until a maximum of 4 points, as new adding of the final note.
Not arriving to the five in the sum of assistance, problems and practical and not to presenting to the objective proof official, the punctuation will be the sum of the addends reached in the methodologies where assisted and realised in the percentage indicated. The no presented will be for the cases in which it have not assisted and realised at all or in the percentages established.
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Sources of information	
Basic	- Monchy, Fransois. (). Teoría y práctica del mantenimiento industrial. París : Masson, 1990 - Gómez de León, Félix Cesáreo (). Tecnología del mantenimiento industrial. Murcia : Universidad de Murcia, 1998 BÁSICA Tecnología del mantenimiento industrial Gómez de León, Félix Cesáreo. Murcia : Universidad de Murcia, 1998 Teoría y práctica del mantenimiento industrial Monchy, Fransois. París : Masson, 1990 Organización y gestión del mantenimiento: manual práctico para la implantación de sistemas de gestión avanzados de mantenimiento industrial García Garrido, Santiago. Madrid : Díaz de Santos, [2003] Teoría y práctica del mantenimiento industrial avanzado González Fernández, Francisco Javier. Madrid : Fundación Confemetal, [2011] La contratación del mantenimiento industrial : procesos de externalización, contratos y empresas de mantenimiento García Garrido, Santiago [Madrid] : Diaz de Santos, [2010] KELLY, A.; HARRIS, M.J: Gestión del mantenimiento industrial. Ed. Fundación REPSOL.S.L. 1998
Complementary	BIBLIOGRAFIA COMPLEMENTARIATécnicas para el mantenimiento y diagnóstico de máquinas eléctricas rotativas.M. Ferandes Cabanas y otros.Marcombo, 1998.Teoría y Práctica del Mantenimiento Industrial.François Monchy. Ed. Masson.Gestión Integral de Mantenimiento? Navarro, Pastor y Mugaburu, Ed. Marcombo. Manual de mantenimiento de instalaciones industriales, Baldin; L. Furlanetto. Gustavo-Gili.Manual del Mantenimiento Industrial (2 tomos), Robert C. Rosaler.McGraw-Hill.Tecnología del mantenimiento industrial, Felix Cesáreo Gómez de León, , , SP-Universidad de Murcia.NORMATIVA SOBRE MANTENIMIENTO INDUSTRIALGestión del mantenimiento.Madrid : AENOR, 2011.Criterios de interpretación para la aplicación de la norma UNE-EN ISO 9001:2000 en empresas de montaje y mantenimiento industrial.Madrid : AENOR, [2004] UNE-ENV 13269:2003. Mantenimiento.UNE-EN 13306:2002. Terminología del mantenimiento

Recommendations
Subjects that it is recommended to have taken before
Statistics/770G01008 Business Management/770G01010 Materials Science/770G01009
Subjects that are recommended to be taken simultaneously
Industrial Management/Industrial Organisation/770G01038 Electronic Instrumentation I/770G01027 Control Engineering/770G01028
Subjects that continue the syllabus
Graduation Proyect /Bachelor Thesis/770G01045
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.