



## Teaching Guide

Teaching Guide				
Identifying Data				2022/23
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	
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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.			

## Study programme competences

Code	Study programme competences
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		
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)	<ul style="list-style-type: none"> <li>- Nature and classification of the material: Material of production. The peripheral material. Installations.</li> <li>- Inventory of the park of material: functional Division and coding.</li> <li>- Historical file of the machinery: The dossier-machine. Utility and exploitation of the historical.</li> </ul>
SUBJECT II. INTRODUCTION TO THE ENGINEERING OF THE MAINTENANCE. (Content: Mantenimineto Industrial and Reliability)	<ul style="list-style-type: none"> <li>- The maintenance correctivo: palliative Maintenance and curativo.0</li> <li>- The preventive maintenance: Concepts and aims. Laws of degradation.</li> <li>- Systematic maintenance. Conditional or predictive maintenance.</li> <li>- The Total Productive Maintenance (TPM): Introduction and concept.</li> <li>- Other activities of the service of maintenance: Improvement, modernisation, renewal and reconstruction.</li> </ul>
SUBJECT III. TYPES OF MAINTENANCE. (Content: Industrial Maintenance and special Maintenances)	<ul style="list-style-type: none"> <li>- Nature and classification of the material: -The maintenance correctivo: palliative Maintenance and curative.</li> <li>- The preventive maintenance: Concepts and aims. Laws of degradation.</li> <li>- Systematic maintenance. Conditional or predictive maintenance.</li> <li>- The Total Productive Maintenance (TPM): Introduction and concept.</li> <li>- Other activities of the service of maintenance: Improvement, modernisation, renewal and reconstruction.</li> </ul>
SUBJECT IV. MANAGEMENT OF THE INDUSTRIAL MAINTENANCE. (Content: Industrial Maintenance, special Maintenances and Reliability)	<ul style="list-style-type: none"> <li>- Study of the failures, tax of failure.</li> <li>- Mantemento Centred na Fiabilidade (RCM).</li> <li>- Analysis of costs of maintenance.</li> <li>- Planning of the maintenance. Charts of GANT and PERT.</li> <li>- Computer-aided maintenance GMAO.</li> <li>- Collected, analysis of data and diagnose.</li> </ul>
SUBJECT V. SPECIAL MAINTENANCES. (Contained special maintenances)	<ul style="list-style-type: none"> <li>- Maintenance mechanical teams: thermography and thermometry, lubricación and vibration.</li> <li>- Maintenance electrical and electronic teams.</li> </ul>
SUBJECT SAW. SPECIFIC STANDARDS ON THE MAINTENANCE. (Content: Specific standards on maintenance)	<p>Standard UNE and disposals:</p> <ul style="list-style-type: none"> <li>- Standard UNE - EN 13306:2018 Terminology of the maintenance.</li> <li>- Standard UNE - EN 13269:2016 Guide for to preparation of agreements of maintenance. -</li> <li>- Standard UNE - EN 13460:2009. Documents for the maintenance.</li> <li>- Standard UNE - EN 15341:2008 Indicators of performance of maintenance.</li> <li>- Standard UNE - CEN/TR 15628: 2015 Qualification of the personnel of mantemiento.</li> <li>- Standard UNE - EN 151001:2011 Indicators of mantenibilidad of industrial devices.</li> </ul>



## Planning

Methodologies / tests	Competencies	Ordinary class hours	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	12	38	50
Problem solving	A4 B1 B2 B3 B4 B5 B9 C3	7.5	18	25.5
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	<ul style="list-style-type: none"> <li>- Explanation of each one of the subjects of the programming with support of presentations type powerpoint and videos, except the parts that entreguen for reading.</li> <li>- Explanation of the operation of teams of measure used in the maintenance.</li> <li>- Some turns of opening debate.</li> </ul>
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	<ul style="list-style-type: none"> <li>- They will realise problems type and questions developed by the professor, to end of clarificar the exposed concepts in the sessions magistrales.</li> <li>- 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.</li> </ul>
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	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	<p>-Proof to realise in the corresponding official announcements and will mark with one maximum of 40% of the final note.</p> <p>-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).</p> <p>-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.</p> <p>- 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.</p>	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.

If he does not appear for the practices, he does not present himself regardless of the score in the other methodologies.

\* Partial enrollment students will be able to agree with the teacher the possibility of doing alternative activities to the face-to-face ones.

\* The criteria for passing the second chance are the same as those for the first chance.

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## Sources of information

Basic	<p>- Monchy, François. (). Teoría y práctica del mantenimiento industrial. París : Masson, 1990</p> <p>- Gómez de León, Félix Cesáreo (). Tecnología del mantenimiento industrial. Murcia : Universidad de Murcia, 1998</p> <p>BÁSICA Tecnología del mantenimiento industrial Gómez de León, Félix Cesáreo. Murcia : Universidad de Murcia, 1998</p> <p>Teoría y práctica del mantenimiento industrial Monchy, François. París : Masson, 1990</p> <p>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]</p> <p>Teoría y práctica del mantenimiento industrial avanzado González Fernández, Francisco Javier. Madrid : Fundación Confemetal, [2011]</p> <p>La contratación del mantenimiento industrial : procesos de externalización, contratos y empresas de mantenimiento García Garrido, Santiago [Madrid] : Díaz de Santos, [2010]</p> <p>KELLY, A.; HARRIS, M.J: Gestión del mantenimiento industrial. Ed. Fundación REPSOL.S.L. 1998</p>
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<b>Complementary</b>	<p>BIBLIOGRAFIA COMPLEMENTARIA Técnicas 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 INDUSTRIAL Gestión 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</p>
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## 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 Project /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.