



## Teaching Guide

| Identifying Data    |   |        |   |         | 2018/19 |
|---------------------|---|--------|---|---------|---------|
| Subject (*)         | Industrial Maintenance  | Code   | 770G01030   |         |         |
| Study programme     | Grao en Enxeñaría Electrónica Industrial e Automática   |        |   |         |         |
| Descriptors         |   |        |   |         |         |
| Cycle               | Period  | Year   | Type  | Credits |         |
| Graduate            | 2nd four-month period   | Third  | Optional  | 6       |         |
| 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.<br>Rodríguez Charlón, Santiago Ángel   | E-mail | consuelo.castilla.pascual@udc.es<br>santiago.rodriguez.charlon@udc.es |         |         |
| Web                 | www.moodle.udc.es   |        |   |         |         |
| General description | It treats of one asignatura that has a carácter 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.  |
| 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<br>B2<br>B3<br>B4<br>B5 | C3 |
| It knows and it has capacity to apply the distinct types of maintenance: electrical, electronic and mechanic. | A4                          | B1<br>B2<br>B3<br>B4<br>B5 | C3 |



|   |    |                            |    |
|---|----|----------------------------|----|
| It applies the concepts of reliability inside the maintenance.  | A4 | B1<br>B2<br>B3<br>B4<br>B5 | C3 |
| It is able to interpret the technical information of the maintenance and of other sources of information in relation. | A4 | B1<br>B2<br>B3<br>B4<br>B5 | 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 13306:2011 Terminology of the maintenance.</li> <li>- Standard UNE - EN 13269:2007 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: 2011 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 B4 B5             | 21                   | 32                            | 53          |
| Laboratory practice            | A4 B1 B2 B4 B5          | 9                    | 10                            | 19          |
| Problem solving                | A4 B1 B2 B3 B4 B5<br>C3 | 21                   | 38                            | 59          |
| Objective test                 | A4 B1 B2 B3 B4 B5       | 5                    | 12                            | 17          |
| 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 entregen 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 obxetiva at the end on of the subjects worked the long of the course. It is compulsory for those students that did not reach the approved with the rasto of the methodologies employed, and is optativa to go up note to which, reaching the tested in them, if this wish it.  |

| Personalized attention                 |  |
|--|--|
| Methodologies                          | Description  |
| Problem solving<br>Laboratory practice | 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 |
| Guest lecture / keynote speech | A4 B2 B4 B5             | Will take into account the assistance regulate 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<br>C3 | The proofs written of resolution of problems contibuirán 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 they realise in the academic course. | 30            |
| Laboratory practice            | A4 B1 B2 B4 B5          | They will compute 20% of the final note if it has 100% of assistance and presents a apt final memory-description.   | 20            |



|                |                   |  |    |
|----------------|-------------------|--|----|
| Objective test | A4 B1 B2 B3 B4 B5 | <ul style="list-style-type: none"> <li>- Proof to realise in the corresponding official announcements and will mark with one maximum of 40% of the final note.</li> <li>- It is forced to do if not to reach the 5 in the sum of the contribucións to final note of the reached in the others meodoloxías of evaluation, and if reached the 5 will be optativa.</li> <li>- The time 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.</li> <li>- The time only is expandable for the student that have conceded adaptation to the diversity that estimate iempo additional established by the service ADI of the UDC.</li> </ul> | 40 |
|----------------|-------------------|--|----|

### Assessment comments

The final punctuation will be:

The sum of the 1 of the assistance to sessions magistrales, more the 2 of the assistance and memory of the practices, and more the punctuation on ten reached in the total of the proofs of solution of problemas realised along the course affected by 30% (this addend adds at most a 3). When the sum of these three addends does 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 porcien, and thus, until a maximum of 4 points, as new adding of the final note.

### Sources of information

|                      |  |
|----------------------|--|
| <b>Basic</b>         | <ul style="list-style-type: none"> <li>- Monchy, Fransois. (). Teoría y práctica del mantenimiento industrial. París : Masson, 1990</li> <li>- Gómez de León, Félix Cesáreo (). Tecnología del mantenimiento industrial. Murcia : Universidad de Murcia, 1998</li> <li>BÁSICA Tecnología del mantenimiento industrial Gómez de León, Félix Cesáreo. Murcia : Universidad de Murcia, 1998</li> <li>Teoría y práctica del mantenimiento industrial Monchy, Fransois. París : Masson, 1990</li> <li>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]</li> <li>Teoría y práctica del mantenimiento industrial avanzado González Fernández, Francisco Javier. Madrid : Fundación Confemetal, [2011]</li> <li>La contratación del mantenimiento industrial : procesos de externalización, contratos y empresas de mantenimiento García Garrido, Santiago [Madrid] : Diaz de Santos, [2010]</li> <li>KELLY, A.; HARRIS, M.J: Gestión del mantenimiento industrial. Ed. Fundación REPSOL.S.L. 1998</li> </ul> |
| <b>Complementary</b> | <p>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</p>  |

### 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.