



## Teaching Guide

| Teaching Guide      |                                                                                                                                                                                                                                                                                                                                                          |        |                                                                                               |           |
|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------------------------------------------------------------------------|-----------|
| Identifying Data    |                                                                                                                                                                                                                                                                                                                                                          |        |                                                                                               | 2020/21   |
| Subject (*)         | TEORÍA DE MÁQUINAS                                                                                                                                                                                                                                                                                                                                       |        | Code                                                                                          | 730G04019 |
| Study programme     | Grao en enxeñaría en Tecnoloxías Industriais                                                                                                                                                                                                                                                                                                             |        |                                                                                               |           |
| Descriptors         |                                                                                                                                                                                                                                                                                                                                                          |        |                                                                                               |           |
| Cycle               | Period                                                                                                                                                                                                                                                                                                                                                   | Year   | Type                                                                                          | Credits   |
| Graduate            | 2nd four-month period                                                                                                                                                                                                                                                                                                                                    | Second | Obligatory                                                                                    | 6         |
| Language            | Spanish                                                                                                                                                                                                                                                                                                                                                  |        |                                                                                               |           |
| Teaching method     | Hybrid                                                                                                                                                                                                                                                                                                                                                   |        |                                                                                               |           |
| Prerequisites       |                                                                                                                                                                                                                                                                                                                                                          |        |                                                                                               |           |
| Department          | Enxeñaría Naval e Industrial                                                                                                                                                                                                                                                                                                                             |        |                                                                                               |           |
| Coordinador         | Cuadrado Aranda, Francisco Javier                                                                                                                                                                                                                                                                                                                        | E-mail | javier.cuadrado@udc.es                                                                        |           |
| Lecturers           | Cuadrado Aranda, Francisco Javier<br>Luaces Fernández, Alberto<br>Lugris Armesto, Urbano<br>Naya Villaverde, Miguel Ángel                                                                                                                                                                                                                                | E-mail | javier.cuadrado@udc.es<br>alberto.luaces@udc.es<br>urbano.lugris@udc.es<br>miguel.naya@udc.es |           |
| Web                 | moodle.udc.es                                                                                                                                                                                                                                                                                                                                            |        |                                                                                               |           |
| General description | Kinematics and dynamics of machines.                                                                                                                                                                                                                                                                                                                     |        |                                                                                               |           |
| Contingency plan    | 1. Modifications to the contents<br><br>2. Methodologies<br>*Teaching methodologies that are maintained<br><br>*Teaching methodologies that are modified<br><br>3. Mechanisms for personalized attention to students<br><br>4. Modifications in the evaluation<br><br>*Evaluation observations:<br><br>5. Modifications to the bibliography or webgraphy |        |                                                                                               |           |

## Study programme competences

| Code | Study programme competences                                                                                                                                                                                                                                                                                                       |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A13  | CR7 Coñecemento dos principios de teoría de máquinas e mecanismos.                                                                                                                                                                                                                                                                |
| B1   | CB1 Que os estudantes demostren posuír e comprender coñecementos nunha área de estudo que parte da base da educación secundaria xeral e adoita encontrarse a un nivel que, aínda que se apoia en libros de texto avanzados, inclúe tamén algúns aspectos que implican coñecementos procedentes da vangarda do seu campo de estudo |
| B2   | CB2 Que os estudantes saiban aplicar os seus coñecementos ao seu traballo ou vocación dunha forma profesional e posúan as competencias que adoitan demostrarse por medio da elaboración e defensa de argumentos e a resolución de problemas dentro da súa área de estudo                                                          |
| B4   | CB4 Que os estudantes poidan transmitir información, ideas, problemas e solucións a un público tanto especializado como leigo                                                                                                                                                                                                     |
| B5   | CB5 Que os estudantes desenvolvan aquelas habilidades de aprendizaxe necesarias para emprenderen estudos posteriores cun alto grao de autonomía                                                                                                                                                                                   |
| B7   | B5 Ser capaz de realizar unha análise crítica, avaliación e síntese de ideas novas e complexas                                                                                                                                                                                                                                    |
| B9   | B8 Adquirir unha formación metodolóxica que garanta o desenvolvemento de proxectos de investigación (de carácter cuantitativo e/ou cualitativo) cunha finalidade estratéxica e que contribúan a situarnos na vangarda do coñecemento                                                                                              |
| C4   | C6 Valorar criticamente o coñecemento, a tecnoloxía e a información dispoñible para resolver os problemas cos que deben enfrontarse.                                                                                                                                                                                              |



|    |                                                                                                                                                  |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------|
| C5 | C7 Asumir como profesional e cidadán a importancia da aprendizaxe ao longo da vida.                                                              |
| C6 | 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 |    |
| Ability to carry out kinematic analysis of mechanisms and machines. Ability to perform forward and inverse dynamics analysis of mechanisms and machines. |  | A13                         | B1 |
|                                                                                                                                                          |  |                             | B2 |
|                                                                                                                                                          |  |                             | B4 |
|                                                                                                                                                          |  |                             | B5 |
|                                                                                                                                                          |  |                             | B7 |
|                                                                                                                                                          |  |                             | B9 |
|                                                                                                                                                          |  | C4                          | C5 |
|                                                                                                                                                          |  |                             | C6 |

| Contents                                                                                           |                                                                                                                                                                                                                                                                           |
|----------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Topic                                                                                              | Sub-topic                                                                                                                                                                                                                                                                 |
| The following topics develop the contents established in the Verification Memory sheet, which are: | Kinematics and dynamics of machines and mechanisms.                                                                                                                                                                                                                       |
| 1. Topological analysis of mechanisms.                                                             | Definitions: mechanism, element, joint, degrees of freedom.<br>Clasification of elements and joints.<br>Degrees of freedom of a mechanism.                                                                                                                                |
| 2. Kinematical analysis of mechanisms.                                                             | Point kinematics: position, velocity and acceleration.<br>Distribution of velocities and accelerations in a rigid body.<br>Relative motion of a material point.<br>Relative motion of a rigid body.<br>Rolling kinematics.<br>Particularization to plane motion.          |
| 3. Dynamic analysis of mechanisms.                                                                 | Fundamentals.<br>Direct dynamic analysis of mechanisms.<br>Inverse dynamic analysis of mechanisms.                                                                                                                                                                        |
| 4. Vibration of single DOF systems.                                                                | Introduction.<br>Equation of motion of a single DOF system.<br>Free vibrations.<br>Forced vibrations.                                                                                                                                                                     |
| 5. Cams and gears.                                                                                 | Classification of cams and followers.<br>Displacement diagrams.<br>Kinematics and dynamics of cams and followers.<br>Classification of gears.<br>Fundamental law of gear-tooth action, involute curve.<br>Spur gears.<br>Helical gears.<br>Gear dynamics.<br>Gear trains. |

| Planning                       |                             |                      |                               |             |
|--------------------------------|-----------------------------|----------------------|-------------------------------|-------------|
| Methodologies / tests          | Competencies                | Ordinary class hours | Student?s personal work hours | Total hours |
| Guest lecture / keynote speech | A13 B4 B5 B7 B9 C4<br>C5 C6 | 26                   | 39                            | 65          |
| Problem solving                | A13 B4 B5 B7 B9             | 21                   | 46.5                          | 67.5        |



|                                                                                                                                 |                    |     |   |     |
|---------------------------------------------------------------------------------------------------------------------------------|--------------------|-----|---|-----|
| Supervised projects                                                                                                             | A13 B1 B2 B5 B7 C4 | 1   | 9 | 10  |
| Mixed objective/subjective test                                                                                                 | A13 B1 B2          | 4.5 | 0 | 4.5 |
| Personalized attention                                                                                                          |                    | 3   | 0 | 3   |
| (*)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  | Chalkboard lectures, with occasional slides in order to show complex figures, pictures, plots, etc. Students will take notes and study the matter on their own.            |
| Problem solving                 | Resolution of problems on the chalkboard. Students take notes. In addition, they have available a collection of solved problems, in order to be able to work on their own. |
| Supervised projects             | Aplicaránse os coñecementos recibidos na teoría para modelizar e analizar mediante métodos numéricos computacionais un mecanismo.                                          |
| Mixed objective/subjective test | Written test, with cocept questions and problems.                                                                                                                          |

| Personalized attention                 |                                                                                                                                   |
|----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| Methodologies                          | Description                                                                                                                       |
| Problem solving<br>Supervised projects | Hours devoted to tutoring are intended to clarify the doubts arisen while the students study the theory and prepare the problems. |

| Assessment                      |                    |                                                                                                                                                |               |
|---------------------------------|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| Methodologies                   | Competencies       | Description                                                                                                                                    | Qualification |
| Problem solving                 | A13 B4 B5 B7 B9    | Algúns dos problemas a realizar entregaránse e serán corrixiados. O sea valor conxunto poderá supor ata o 30 % da nota.                        | 30            |
| Mixed objective/subjective test | A13 B1 B2          | The test consists of concept questions and problems. The evaluation criterion is whether the student shows enough understanding of the matter. | 30            |
| Supervised projects             | A13 B1 B2 B5 B7 C4 | Entregarase unha memoria do mecanismo analizado e mailo programa de ordenador coa solución proposta.                                           | 40            |
| Others                          |                    |                                                                                                                                                |               |

| Assessment comments                                                                                                                                                                                                                                                                                                                                                                                                                      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Perante o curso realizaránse probas que poden ter un valor de ata tres puntos. O traballo tutelado pode valer ata catro puntos. O examen terá o seu valor sobre o total dos puntos que faltan hasta 10. No caso de estudantes con dispensa académica, o sistema de avaliación será o mesmo, pois só hai que asistir o día do exame. El criterio de evaluación es el mismo tanto para a primeira como para a segunda oportunidade.</p> |

| Sources of information |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Basic                  | <p>- CALERO R. y CARTA J.A., "Fundamentos de Mecanismos y Máquinas para Ingenieros", McGraw-Hill, 1999. - ERDMAN, A.G. y SANDOR, G.N., "Diseño de Mecanismos", 3ª ed., Prentice-Hall, 1998. - MABIE, H.H. and REINHOLTZ, C.F., "Mechanisms and Dynamics of Machinery", Wiley, 1987. - NORTON, R.L., "Diseño de Maquinaria", 3ª ed., McGraw-Hill, 2004. - UICKER, J.K., PENNOCK, G.R. and SHIGLEY, J.E., "Theory of Machines and Mechanisms", 3rd ed., Oxford University Press, 2003.- RAO, S., "Mechanical Vibrations", Addison-Wesley, 1995.</p> |



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|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Complementary</b> | - BARTON, L.O., "Mechanism Analysis", 2nd edition, Marcel Dekker, 2001. - JOSEPHS, H. and HUSTON, R.L., "Dynamics of Mechanical Systems", CRC Press, 2002. - HERNANDEZ, A., "Cinemática de Mecanismos", Editorial Síntesis, 2004. - RAMAMURTI, V., "Mechanics of Machines", CRC Press, 2002. - WALDRON, K.J and KINZEL, G.L., "Kinematics, Dynamics, and Design of Machinery", Wiley, 1999. |
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## Recommendations

### Subjects that it is recommended to have taken before

EXPRESION GRAFICA/730G04002

FÍSICA I/730G04003

### Subjects that are recommended to be taken simultaneously

### Subjects that continue the syllabus

Manufacturing Processes/730G04022

### 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 de traballos que se realicen nesta materia:- Solicitarse en formato virtual e/ou soporte informático.- Realizarse a través da web da materia, en formato dixital, sen necesidade de imprimilos.- En caso de ser necesario realízalos en papel: non se empregarán plásticos; realizaranse impresións a dobre cara; empregarse papel reciclado; evitarse a impresión de borradores. Débese facer un uso sustentable dos recursos e a prevención de impactos negativos sobre o medio natural.

(\*)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.