



## IDENTIFYING DATA

### Mechanism and machine theory

|                     |  |           |      |            |
|---------------------|--|-----------|------|------------|
| Subject             | Mechanism and machine theory   |           |      |            |
| Code                | V12G363V01303  |           |      |            |
| Study programme     | Degree in Industrial Technologies Engineering  |           |      |            |
| Descriptors         | ECTS Credits   | Choose    | Year | Quadmester |
|                     | 6  | Mandatory | 2nd  | 1st        |
| Teaching language   | Spanish<br>Galician<br>English   |           |      |            |
| Department          |  |           |      |            |
| Coordinator         | Fernández Vilán, Ángel Manuel<br>Segade Robleda, Abraham   |           |      |            |
| Lecturers           | González Baldonado, Jacobo<br>López Campos, José Ángel<br>Segade Robleda, Abraham  |           |      |            |
| E-mail              | asegade@uvigo.es<br>avilan@uvigo.es  |           |      |            |
| Web                 | <a href="http://fatic.uvigo.es">http://fatic.uvigo.es</a>  |           |      |            |
| General description | This subject is intended to provide the students with basic knowledge about Mechanism and Machine Theory as well as his applications in the field of Mechanical engineering. It also covers and provides the students with the most important concepts related with Mechanism and Machine Theory. The students will know and apply kinematic and dynamic analysis methods for mechanical systems both with graphical and analytical methods and also through effective use of simulation software. Furthermore, this subject serves as an introduction of some aspects about machinery design; a topic that will be cover thoroughly in future subjects of the Degree. |           |      |            |

## Competencies

Code

## Learning outcomes

|                                    |                               |
|------------------------------------|-------------------------------|
| Expected results from this subject | Training and Learning Results |
|------------------------------------|-------------------------------|

## Contents

|  |  |
|--|--|
| Topic  |  |
| Introduction to mechanism and machine theory | Introduction<br>Definition of Machine, Mechanism and Kinematic Chain Link/part and linkage/joint<br>Classification<br>Kinematic Diagram, modeling, and symbology (nomenclature)<br>Mobility<br>Degrees of freedom<br>Synthesis of mechanisms |
| Geometrical analysis of mechanisms.          | Introduction<br>Calculation methods of placement<br>Loop closure equations   |
| Kinematic analysis of mechanisms             | Fundamentals<br>Graphical methods<br>Analytical methods<br>Matrix methods  |
| Static analysis of mechanisms                | Fundamentals<br>Force reduction (Graphical Methods)<br>Work/Power Virtual Methods  |

|                                |   |
|--------------------------------|---|
| Dynamic analysis of mechanisms | Fundamentals<br>Machine general dynamics<br>Machine Work and Power<br>Balanced Dynamics of rotors |
| Cam mechanisms                 | Fundamentals<br>Flat cams<br>Cam synthesis  |
| Power transmission mechanisms  | Fundamentals<br>Gears Mechanism<br>Other mechanisms   |

## Planning

|                      | Class hours | Hours outside the classroom | Total hours |
|----------------------|-------------|-----------------------------|-------------|
| Lecturing            | 23          | 19.5                        | 42.5        |
| Problem solving      | 9.5         | 30                          | 39.5        |
| Laboratory practical | 18          | 47                          | 65          |
| Essay questions exam | 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

|                      | Description  |
|----------------------|--|
| Lecturing            | Clase magistral en la que exponen los contenidos teóricos.                     |
| Problem solving      | Resolución de problemas utilizando los conceptos teóricos presentados en aula. |
| Laboratory practical | Realización de tareas prácticas en laboratorio docente o aula informática      |

## Personalized assistance

| Methodologies        | Description   |
|----------------------|---|
| Lecturing            | Group or individual tutorials will be held during office hours to strengthen the acquired knowledge and to guide and assess the proposed works/papers . |
| Problem solving      | Group or individual tutorials will be held during office hours to strengthen the acquired knowledge and to guide and assess the proposed works/papers.  |
| Laboratory practical | Group or individual tutorials will be held during office hours to strengthen the acquired knowledge and to guide and assess the proposed works/papers.  |

## Assessment

|                      | Description   | Qualification | Training and Learning Results |
|----------------------|---|---------------|-------------------------------|
| Laboratory practical | Attendance and participation as well as practices reports, papers, and tests will be rated. However, to be evaluated, students must attend a minimum of 7 practice sessions; otherwise, students won't be evaluated and will get 0 points.<br>Learning outcomes: all will be graded | 20            |                               |
| Essay questions exam | Final and mid-term tests will be focused on the contents taught at classes and laboratory sessions.<br>Learning outcomes: all will be graded.   | 80            |                               |

## Other comments on the Evaluation

Students must achieve a 5 or higher grade\* to pass the subject, following these rules:

1. Students are required to attend and utilized the laboratory/Computer room. Practices reports, papers, and tests for each practice session as well as proposed works/papers from tutorials will be evaluated and graded with a maximum of 2 points of the final grade. This grade will be kept for the second term in the student's evaluation records (July). To be evaluated, students must attend a minimum of 7 practice sessions; otherwise, students won't be evaluated and will get 0 points.
2. For those students who have been officially granted the right to waive their continued evaluation, there will be a mandatory final test where they will be able to get a maximum grade of 2 points. However, an advanced request must be made to the professor to prepare the necessary materials for this test.
3. The final test will have a maximum grade of 8 points.

\* Grades are calculated using a system of numerical qualification from 0 to 10 points conforming to the Spanish current legislation (RD 1125/2003, 5 September; BOE 18 September).

Ethical commitment: An adequate ethical behaviour of the student is expected at all times. In case an unethical behaviour is detected (copying, plagiarism, unauthorized use of electronic devices, and others); the student will be considered unfit to meet the necessary requirements to pass the subject. In this case, the overall qualification in the current academic year will be a Fail grade (0.0).

The use of any electronic devices during tests is completely forbidden unless is specified and authorized. The fact of introducing unauthorized electronic devices in the examination room will be considered reason enough to fail the subject in the current academic year and the overall qualification will be a Fail grade (0.0).

Tests Schedule: This information can be found along with any updates at the center (university) webpage.

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## Sources of information

### Basic Bibliography

Munir Khamashta, **Problemas resueltos de cinemática de mecanismos planos**, UPC,

Munir Khamashta, **Problemas resueltos de dinámica de mecanismos planos**, UPC,

Calero Pérez, R. y Carta González, J.A., **Fundamentos de mecanismos y máquinas para ingenieros**, McGraw-Hill,

### Complementary Bibliography

García Prada, J.C. Castejón, C., Rubio, H., **Problemas resueltos de Teoría de Máquinas y mecanismos**, THOMSON,

Cardona, S. y Clos D., **Teoría de Máquinas.**, UPC,

Shigley, J.E.; Uicker J.J. Jr., **Theory of Machines and Mechanisms**, McGraw-Hill,

Hernández A, **Cinemática de mecanismos: Análisis y diseño**, SÍNTESIS,

Lamadrid Martínez, A.; Corral Sáiz, A., **Cinemática y Dinámica de Máquinas**, E.T.S.I.I.T,

Mabie, Reinholtz, **Mechanisms and dynamics of machinery**, Limusa-wiley,

Nieto, j., **Síntesis de Mecanismos**, AC,

Erdman, A.G.; Sandor, G.N., **Mechanism Design: Analysis and Synthesis**, PRENTICE HALL,

Simon A.; Bataller A; Guerra J.; Ortiz, A.; Cabrera, J.A., **Fundamentos de teoría de Máquinas**, BELLISCO,

Kozhevnikov SN, **Mecanismos**, Gustavo Gili,

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## Recommendations

### Subjects that continue the syllabus

Machine design I/V12G380V01304

Automobiles and railways/V12G380V01941

Design of hydraulic machines and oleo-pneumatic systems/V12G380V01914

Machine design II/V12G380V01911

Computer-aided mechanical design/V12G380V01915

Transport engineering/V12G380V01945

Thermal engines and machines/V12G380V01913

Systems for data analysis, simulation and validation/V12G380V01933

Hybrid and electric automotive vehicles/V12G380V01944

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

Graphic expression: Graphic expression/V12G380V01101

Physics: Physics I/V12G380V01102

Mathematics: Algebra and statistics/V12G380V01103

Mathematics: Calculus I/V12G380V01104

Mathematics: Calculus II and differential equations/V12G380V01204

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### Other comments

Requirements: to enrol in this subject, it is mandatory to have passed or at least, to be enrolled of all first year subjects.

In case of discrepancies, the Spanish version of this guide prevails.