# Universidade de Vigo

## IDENTIFYING DATA

### Mechanism and machine theory

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|---|---|
| Subject | Mechanism and machine theory |
| Code | V12G380V01306 |
| Study programme | Grado en Ingeniería Mecánica |

| 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 | Fernández Álvarez, José Manuel<br>Fernández Vilán, Ángel Manuel<br>González Baldonedo, Jacobo<br>Segade Robleda, Abraham |
| E-mail | asegade@uvigo.es<br>avilan@uvigo.es |
| Web | http://moovi.uvigo.gal/ |
| 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. |

## Skills

| Code | |
|---|---|
| B3 | CG3 Knowledge in basic and technological subjects that will enable students to learn new methods and theories, and provide them the versatility to adapt to new situations. |
| B4 | CG4 Ability to solve problems with initiative, decision making, creativity, critical thinking and the ability to communicate and transmit knowledge and skills in the field of industrial engineering in Mechanical specialty. |
| C13 | CE13 Knowledge of the principles of the theory of machines and mechanisms. |
| D2 | CT2 Problems resolution. |
| D6 | CT6 Application of computer science in the field of study. |
| D9 | CT9 Apply knowledge. |
| D10 | CT10 Self learning and work. |
| D16 | CT16 Critical thinking. |

## Learning outcomes

| Expected results from this subject | Training and Learning Results | | |
|---|---|---|---|
| To know the fundamentals of Mechanism and Machines Theory, and the application of these concepts concerning to the field of Mechanical engineering to solve problems related with this subject in the Industrial Engineering field. | B3<br>B4 | C13 | D2<br>D6<br>D9<br>D10<br>D16 |
| To know, comprehend, apply, and practice the concepts related to Mechanism and Machines Theory. | B3<br>B4 | C13 | D2<br>D6<br>D9<br>D10<br>D16 |

| To know and apply kinematic and dynamic analyses techniques to mechanical systems. | B3 B4 | C13 | D2 D6 D9 D10 D16 |
| --- | --- | --- | --- |
| Efficiently know and utilize software for analysis of mechanisms. | B3 B4 | C13 | D2 D6 D9 D10 D16 |

## Contents

| Topic | |
| --- | --- |
| Introduction to mechanism and machine theory | Introduction Definition of Machine, Mechanism and Kinematic Chain Link/part and linkage/joint Classification Kinematic Diagram, modeling, and symbology (nomenclature) Mobility Degrees of freedom Synthesis of mechanisms |
| Geometrical analysis of mechanisms. | Introduction Calculation methods of placement Loop closure equations |
| Kinematic analysis of mechanisms | Fundamentals Graphical methods Analytical methods Matrix methods |
| Static analysis of mechanisms | Fundamentals Force reduction (Graphical Methods) Work/Power Virtual Methods |
| Dynamic analysis of mechanisms | Fundamentals Machine general dynamics Machine Work and Power Balanced Dynamics of rotors |
| Cam mechanisms | Fundamentals Flat cams Cam synthesis |
| Power transmission mechanisms | Fundamentals Gears Mechanism 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 | Master class where the theoretical concepts are explain |
| Problem solving | Problem solving using the theoretical concepts presented in the Master Lesson |
| Laboratory practical | Practical tasks developed at the teaching laboratory or computer lab. |

## 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 | B3<br>B4 | C13 | D2<br>D6<br>D9<br>D10<br>D16 |
| 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 | B3<br>B4 | C13 | D2<br>D9<br>D10<br>D16 |

## Other comments on the Evaluation

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

- Laboratory Practical.

    - 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.

    - 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.

- Essay questions exam. It 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.

## 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 diseňo**, 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-wyley,

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,

## 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

### 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

### 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.