



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	English			
Department				
Coordinator	Fernández Vilán, Ángel Manuel Segade Robleda, Abraham			
Lecturers	Fernández Vilán, Ángel Manuel Segade Robleda, Abraham			
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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	
B3	CG3 Knowledge in basic and technological subjects that will enable them to learn new methods and theories, and equip them with versatility to adapt to new situations.
B4	CG4 Ability to solve problems with initiative, decision making, creativity, critical thinking and to communicate and transmit knowledge, skills and abilities in the field of Industrial Engineering.
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	C13	D2
	B4		D6
			D9
			D10
			D16
To know, comprehend, apply, and practice the concepts related to Mechanism and Machines Theory.	B3	C13	D2
	B4		D6
			D9
			D10
			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	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. Learning outcomes: all will be graded	20	B3 B4	C13	D2 D6 D9 D10 D16	
Essay questions exam	Final and mid-term tests will be focused on the contents taught at classes and laboratory sessions. Learning outcomes: all will be graded.	80	B3 B4	C13	D2 D9 D10 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 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,

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.

Contingency plan

Description

In the event that attendance to classes become legally entirely or partially limited, the measures set on place will be:

1. To guarantee the necessary means, namely personal computer or internet access, to every enrolled student so they can follow the distance learning classes, appropriately. Therefore, to apply the appropriate solutions, any student who does not have any of these means should inform the course coordinator.

2. To inform students of the different measures adopted, the department will use the platform, Faitic.

3. On top of that, in the case of cancelation of face-to-face classes, the teaching guide will show the next modifications:

A. Competences. They will not be modified.

B. Learning outcomes. They will not be modified.

C. Contents. They will not be modified.

D. Planning. It will not be modified.

E. Methodology. It will be modified:

Lecturing and Problem solving. They will require the employment of electronic means (virtual classroom of the Remote Campus or others).

Laboratory Practices. The department will provide every student access to dynamic simulation software, so that they can carry out the practices remotely instead of from the Mechanical Engineering laboratory. The professor will supervise these practices using electronic means (virtual classroom of the Remote Campus or others).

F. Tutoring Lessons. They will be carried out by previously arranged electronic means (e-mail, faitic forums, virtual classroom at campus remote, [□](#)).

G. Assessment. Assessment methodologies/test will not be modified: Laboratory practical and Essay questions exam.

Description, weight, and competences they will not be modified. All exams will use electronic means (virtual classroom of the Remote Campus or others); the department will publish in advance the specific rules for each test in the platform, Faitic. According to attendance at the virtual practice sessions, the professor will compute and validate each practice attendance on virtual classroom of the Remote Campus.

Partial tests for the evaluation of specific contests of the subject can be proposed. Once again, the professor will publish in advance the rules concerning each test in the platform, Faitic.

H. Bibliography. Besides the bibliographical references found in this guide, the documentation provided at Faitic, and the problem bulletins and previous exams, the professor might facilitate additional notes, videos, web-references, and others, so that students can appropriately follow the course during the non-face-to-face classes.

This guide can be modified following Rectoral rules.
