



Universitat de Lleida

DEGREE CURRICULUM  
**THEORY OF MECHANISMS**

Coordination: SOLÉ CUTRONA, CRISTIAN

Academic year 2019-20

## Subject's general information

<b>Subject name</b>	THEORY OF MECHANISMS			
<b>Code</b>	102110			
<b>Semester</b>	1st Q(SEMESTER) CONTINUED EVALUATION			
<b>Typology</b>	<b>Degree</b>	<b>Course</b>	<b>Character</b>	<b>Modality</b>
	Bachelor's Degree in Automation and Industrial Electronic Engineering	2	COMPULSORY	Attendance-based
	Not informed	2	COMPULSORY	Attendance-based
	Bachelor's Degree in Energy and Sustainability Engineering	2	COMPULSORY	Attendance-based
	Bachelor's Degree in Mechanical Engineering	2	COMPULSORY	Attendance-based
<b>Course number of credits (ECTS)</b>	6			
<b>Type of activity, credits, and groups</b>	<b>Activity type</b>	PRALAB	PRAULA	TEORIA
	<b>Number of credits</b>	0.6	2.4	3
	<b>Number of groups</b>	8	4	3
<b>Coordination</b>	SOLÉ CUTRONA, CRISTIAN			
<b>Department</b>	COMPUTER SCIENCE AND INDUSTRIAL ENGINEERING			
<b>Teaching load distribution between lectures and independent student work</b>	Attendance work: 40 % Autonomous work: 60 %			
<b>Important information on data processing</b>	Consult <a href="#">this link</a> for more information.			
<b>Language</b>	Catalan. Also some material in spanish or in english			
<b>Office and hour of attention</b>	Joan Roca Enrich Monday, 12 to 13. Wednesday, 17 to 18 Martí Comellas Andrés Monday, 17 to 18. Thursday, 12 to 13 Xavier Terribas Sala			

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
SOLE CUTRONA, CRISTIAN	cristian.sole@udl.cat	7,2	
TERRIBAS SALA, XAVIER	xavier.terribas@udl.cat	16,2	

## Subject's extra information

The main background needed to take advantage of the subject are: operations with vectors, trigonometry, derivatives and integrals of one variable, graphical representation of multi-body systems, dynamics of a mass particle

It is essential to have studied previously, and it is advisable to have passed, the following subjects:

- Linear Algebra
- Calculus
- Physics I
- Graphics Expression I

### Regarding the safety rules that apply to the laboratory practices:

It is **COMPULSORY** that the students bring the following elements of individual protection (EPI) to the practices at the laboratory.

- Blue laboratory gown from UdL (unisex)
- Protection glasses
- Mechanical protection gloves

They can be purchased through the shop Údels of the UdL:

C/ Jaume II, 67 baixos  
Centre the Cultures i Cooperació Transfronterera

<http://www.publicacions.udl.cat/>

The use of other elements of protection (for example caps, masks, gloves of chemical or electrical risk, etc.) will depend on the type of practice to be done. In that case, the teacher will inform of the necessity of specific EPI.

Not bringing the EPI's described or not fulfilling the norms of general security that are detailed below imply that the student can not access to the laboratories or have to go out of them. The no realisation of the practices for this reason imply the **consequences in the evaluation** of the subject that are described in this course guide.

## GENERAL NORMS OF SECURITY IN LABORATORY PRACTICES

- Keep the place of realisation of the practices clean and tidy. The table of work has to be free from backpacks, folders, coats...
- No short trousers or short skirts are allowed in the laboratory.
- Closed and covered footwear is compulsory in the laboratory.
- Long hair needs to be tied.
- Keep the laboratory gown laced in order to be protected from spills of chemicals.
- Bangles, pendants or wide sleeves are not allowed as they can be trapped.
- Avoid the use of contact lenses, since the effect of the chemical products is much bigger if they enter between the contact lense and the cornea. Protection over-glasses can be purchased.
- No food or drink is allowed in the laboratory.
- It is forbidden to smoke in the laboratories.
- Wash your hands whenever you have contact with a chemical product and before going out of the laboratory.
- Follow the instructions of the teacher and of the laboratory technicians and ask for any doubt on security.

For further information, you can check the following document of the *Servei de Prevenció de Riscos Laborals de la UdL*: <http://www.sprl.udl.cat/alumnes/index.html>

## Learning objectives

- Get a deeper knowledge about rigid body mechanics
- Analyze the typology and the constituent elements of a mechanism
- Study the possibilities of movement of a given mechanism
- Analyze the kinematics of a mechanism, concerning positions, speeds and accelerations
- Analyze the dynamics of a mechanism at a given instant
- Analyze the dynamics of a mechanism considering the evolution between two specific situations

## Competences

### Cross-disciplinary competences

- **EPS1.** Capacity to solve problems and prepare and defence arguments inside the area of studies.
- **EPS2.** Capacity to gather and interpret relevant data, within the area of study, to judge and think about relevant subjects of social, scientific and ethical nature.
- **EPS7.** Capacity to work in situations with a lack of information and/or under pressure.

### Specific competences

- **GEM13.** Knowledge of the principles of theory of machines and mechanisms.

## Subject contents

1. Rigid body kinematics
2. Rigid body dynamics: momentum and angular momentum
3. Introduction to mechanisms
4. Mobility of mechanisms
5. Mechanism kinematics

6. Mechanism dynamics: vectorial theorems

7. Energy theorem applied to mechanism dynamics

## Methodology

**Lectures:** They will take place during the Full Group sessions. Explanation of theoretical content and proposal and/or resolution of some practical examples.

**Problems:** They will take place during the Half Group sessions. Approach and discussion of some problems that the students will solve individually or in groups.

**Practices:** They will take place during the Half Group sessions. 2 Practices at the Mechanics laboratory, analysing and measuring variables of mechanical systems, 1 practice about graphical kinematics using CAD.

**Work in group:** Development of 2 works about kinematic and dynamic analysis of different systems.

## Development plan

Week	Methodology	Unit	Attendance hours	Autonomous work hours
1	Lectures	Unit 0: Introduction	2	0
2	Lectures Problems	Unit 1: Theory Unit 1: Problems	2 2	4
3	Lectures Problems	Unit 1: Theory Unit 1: Problems	2 2	4
4	Lectures Problems	Unit 2: Theory Unit 2: Problems	2 2	4
5	Lectures Practice	Unit 2: Theory Practice 1	2 1	6
6	Lectures Problems	Unit 3: Theory Unit 3: Problems	2 2	4
7	Lectures Problems	Unit 4: Theory Unit 4: Problems	2 2	4
8	Lectures Practice	Unit 4: Theory Practice 2	2 1	6
9	Evaluation	Exam 1	2	5
10	Lectures Problems	Unit 5: Theory Unit 5: Problems	2 2	6
11	Lectures Practice	Unit 5: Theory Practice 3	2 2	8
12	Lectures Problems	Unit 6: Theory Unit 6: Problems	2 2	6
13	Lectures Problems	Unit 6: Theory Unit 6: Problems	2 2	6

14	Lectures Problems	Unit 7: Theory Unit 7: Problems	2 2	6
15	Lectures Problems	Unit 7: Theory Unit 7: Problems	2 2	6
16-17	Evaluation	Exam 2	2	7
18	Tutoring	Tutoring	2	4
19	Evaluation	Recovery exam	2	4

## Evaluation

There will be several evaluation activities:

- 1st individual written exam (week 9). Multiple choice exam, the content to be evaluated is the one exposed and worked in class up to the date of this exam.
- 2n individual written exam (week 9). The content to be evaluated is the problems, the works in group and the practice sessions realised up to the date of this exam.
- 3rd individual written exam (week 16 or 17). Multiple choice exam, the content to be evaluated is the one exposed and worked in class from the 1<sup>st</sup> and 2n exams date on.
- 4th individual written exam (week 16 or 17). The content to be evaluated is the problems, the works in group and the practice sessions realised from the 1<sup>st</sup> and 2n exams date on.
- In order to pass the subject, a minimum mark of 3 out of 10 must be reached as the weighed mark of the 4 individual exams. If this minimum mark of 3 is not reached, the subject mark will be the minimum between the 4 exams weighed mark and 3.
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- Practice sessions in the laboratory that are mandatory. Reports from the practice sessions will be evaluate as Right or Wrong.
- 2 works in group about kinematic and dynamic analysis
- Recovery exam of the individual ones (week 20).

The weight assigned to each evaluation activity, out of 100, is as follows:

Activity	Weight
1st individual exam	15
2n individual exam	15
3rd individual exam	25
4th individual exam	25
Work in group	20
Recovery exam of the individual ones	80

Note: in case a student doesn't attend to any of the practice sessions, the mark of the subject will be "Not Presented"


## Bibliography

Lecture notes about the subject

BEDFORD, A. & FOWLER, W. (1996) *Mecánica para Ingeniería. Dinámica*. Addison-Wesley Iberoamericana.E.U.A.

BEER, F.P. & JOHNSTON, E.R. (1998) *Mecánica Vectorial para ingenieros. Dinámica*. McGraw Hill.

HIBBELER, R.C.(1996) *Ingeniería Mecánica. Dinámica*.Prentice-Hall Hispanoamericana. México.

MERIAM, J.L. & KRAIGE, L.G.(1998) *Engineering Mechanics. Dynamics*.John Wiley & Sons. USA.

MYSZKA,D. (1998) *Machines and Mechanisms. Applied Kinematic Analysis*. Prentice Hall. New Jersey.

CARDONA, S. et al. (1998) *Teoria de Màquines*. Ed. CPDA-ETSEIB.Barcelona.

MABIE, H & REINHOLTZ, C. (1998) *Mecanismos y Dinámica de Maquinaria*. Limusa.México.

RIBA, C. (1995) *Dissenyde Màquines I. Mecanismes*. Edicions UPC. Barcelona.

NORTON, R.L. (1995) *Diseño de Maquinaria*. McGraw Hill. México.

SHIGLEY & MISCHKE.*Diseño en Ingeniería Mecánica*. McGraw Hill.

## Adaptations to the evaluation due to COVID-19

The subject of Theory of Mechanisms-Repeated Teaching will continue with the same methodology of evaluation of a single examination at the end of the semester, as it was originally planned before the situation occurred by the Covid-19.