



Universitat de Lleida

DEGREE CURRICULUM **MECHATRONICS II**

Coordination: GREGORIO LOPEZ, EDUARD

Academic year 2023-24

Subject's general information

Subject name	MECHATRONICS II			
Code	102137			
Semester	2nd Q(SEMESTER) CONTINUED EVALUATION			
Typology	Degree	Course	Character	Modality
	Bachelor's Degree in Automation and Industrial Electronic Engineering	4	OPTIONAL	Attendance-based
	Bachelor's Degree in Mechanical Engineering	4	OPTIONAL	Attendance-based
Course number of credits (ECTS)	6			
Type of activity, credits, and groups	Activity type	PRALAB	PRAULA	TEORIA
	Number of credits	2	2	2
	Number of groups	1	1	1
Coordination	GREGORIO LOPEZ, EDUARD			
Department	AGRICULTURAL AND FOREST SCIENCES AND ENGINEERING			
Teaching load distribution between lectures and independent student work	40% at the class, 60% autonomous work. See the "Development plan".			
Important information on data processing	Consult this link for more information.			
Language	English			

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
GREGORIO LOPEZ, EDUARD	eduard.gregorio@udl.cat	7,2	To arrange.

Subject's extra information

This course presents the main types of electrical, hydraulic and pneumatic actuators used in mechatronics and robotics. Knowledge and appropriate selection of these actuators is essential for engineers who wish to work in automation and in the development of industrial products and equipment. The course combines the presentation of theoretical concepts and exercises with its practical application in laboratory.

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

- 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 laboratoy 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

The goal of this course is to provide an overview of the main actuators used in industry. Specific objectives of this subject are.

- Identify and understand the application of the main electrical machines used in the industry.
- Know and apply techniques for the starting and speed control of electric motors.
- Identify and understand the application of the main hydraulic components used in industry .
- Hydraulic circuits designed for simple applications.
- Pneumatic circuits designed for simple applications.
- Implement different hydraulic and pneumatic circuits as well as electric actuators in laboratory.
- Simulate hydraulic and pneumatic circuits using specific software.

Competences

Strategic competences of the UdL:

- UdL2 Command of a foreign language.

Cross-disciplinary competences:

- EPS4. To have the skills required to undertake new studies or improve the training with self-direction.
- EPS9. Capacity for unidisciplinary and multidisciplinary teamwork.

Specific competences:

- GEM28 / GEEIA31. Applied knowledge to measurement systems and industrial actuators.
- GEM29 / GEEIA32. Capacity to design and implement control and automation of mechanical systems.
- GEM30 / GEEIA33. Applied knowledge to multibody mechanisms and robotics.

Subject contents

1. Electric Actuators

- 1.1. Principles of electric machinery.
- 1.2. Induction motors.
- 1.3. Synchronous motors.
- 1.4. DC motors.
- 1.5. Other electrical devices.

2. Hydraulic Actuators

- 2.1. Principles of hydraulics. Symbology.
- 2.2. Hydraulic pumps.

2.3. Hydraulic cylinders. Hydraulic motors. Hydraulic accumulators.

2.4. Regulation and control elements. Valves. Hydraulic circuits.

3. Pneumatic Actuators

3.1. Production, processing and distribution of compressed air.

3.2. Pneumatic actuators. Pneumatic valves.

3.3. Design of pneumatic circuits. Cascade method.

3.4. Electrohydraulics, electropneumatics and automation of circuits.

Methodology

- **Lectures:** Classes to explain the theory and problem solving.
- **Resolution of problems:** Students solve problems individually during these sessions under the supervision of teachers of the subject.
- **Practices (simulation):** design and simulation of hydraulic and pneumatic circuits using specific software (Festo FluidSIM 5 Hidráulica, Festo FluidSIM 5 Neumática).
- **Practices (laboratory):** assembly and control of electrical, hydraulic and pneumatic circuits.
- **Works.** Among others, can include circuit design, bibliographic search, etc.

Development plan

The following plan may be subject to change depending on the number of students and the evolution of the group.

Week	Metodology	Contents	Class hours	Hours of autonomous work
1-3	Lectures Resolution of problems	1. Electric actuators	10	16
3-5	Lectures Resolution of problems	2. Hydraulic actuators	10	16
6-10	Lectures Resolution of problems	3. Pneumatic actuators	14	21
9	Exam PA1	1. Electric actuators 2. Hydraulic actuators	2	
11-15	Practices	1. Electric actuators 2. Hydraulic actuators 3. Pneumatic actuators	16	27
12-15	Work - Resolution of doubts	3. Pneumatic actuators	4	10
16-18	Delivery of the work	3. Pneumatic actuators		
20-21	Recovery exam	1. Electric actuators 2. Hydraulic actuators	2	
20-21	Delivery of recovery work/activities	3. Pneumatic actuators		

Evaluation

Evaluation blocks	%
PA1. Exam (units 1 and 2)	40
Work (unit 3)	30
Practices	30
Recovery exam (units 1 and 2)	40
Recovery work / activities	30

Guidelines for the evaluation of the subject.

- To pass the subject it is necessary to have a final grade of 5.

Exam

- In the 8th week the scheduled exam PA1, corresponding to units 1 and 2, will be performed. Exam PA1 has a weight of 40% over the final grade of the course.
- The exam PA1 can be recovered by completing an exam (20th week).

Work

- A work corresponding to unit 3 will be carried out. This work has a weight of 30% over the final grade of the course.
- The grade of the work can be recovered by completing the work or recovery activities proposed by the professor.

Practices

- The practices grade cannot be recovered by performing another recovery activity.

Alternative evaluation.

- The student who is granted the option of alternative evaluation must take an exam where all the contents of the subject will be assessed. This exam will be held on the date set for the PA2 exam in the school's exam calendar. This exam has a weight of 70% over the final grade of the course. This exam can be recovered by taking a recovery exam on the date set in the school's exam calendar.
- The student who is granted the option of alternative evaluation must also attend the practices sessions that will take place throughout the course and must deliver the reports corresponding to these sessions. Attendance at these practices and delivery of the corresponding reports has a weight of 30% over the final grade of the course. The practices grade cannot be recovered by performing other recovery activities.

Bibliography

1. Electric Actuators

Stephen J. Chapman, 2012. *Máquinas Eléctricas*. 5a edición, McGraw-Hill, 502 pp.

Jesús Fraile Mora, 2008. *Máquinas Eléctricas*. 6a edición, McGraw-Hill, 832 pp.

2. Hydraulic Actuators

Antonio Serrano Nicolás, 2002. *Oleohidráulica*. Madrid, McGraw-Hill Profesional, 483 pp.

3. Pneumatic Actuators

Antonio Serrano Nicolás, 2011. *Neumática práctica*. Madrid, Paraninfo, 450 pp.

Werner Deppert, Kurt Stoll, 1990. *Aplicaciones de la neumática*. Barcelona, Marcombo, 134 pp.

Werner Deppert, Kurt Stoll, 1988. *Dispositivos neumáticos*. Barcelona, Marcombo, 188 pp