



Universitat de Lleida

DEGREE CURRICULUM **MECHATRONICS II**

Coordination: GREGORIO LÓPEZ, EDUARD

Academic year 2018-19

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 Mechanical Engineering	4	OPTIONAL	Attendance-based
	Bachelor's Degree in Automation and Industrial Electronic 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 LÓPEZ, EDUARD			
Department	AGRICULTURAL AND FOREST ENGINEERING			
Teaching load distribution between lectures and independent student work	40% at the classroom, 60% autonomous work. See the "Development plan".			
Important information on data processing	Consult this link for more information.			
Language	English / Catalan			
Office and hour of attention	To arrange with the professor			

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
GENÉ MOLA, JORDI	jgene@eagrof.udl.cat	2,1	
GREGORIO LÓPEZ, EDUARD	egregorio@eagrof.udl.cat	5,1	

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 compoments used in industry .
- Hydraulic circuits designed for simple applications.
- Pneumatic circuits designed for simple applications.
- Implement different hydraulic, pneumatic and electrical circuits in laboratory from an outline.
- Simulate hydraulic, pneumatic and electrical 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 and robotic mechanisms.

Subject contents

1. Electric Actuators

- 1.1. Principles of electric machinery.
- 1.2. Induction motors. Power and torque. Starting of motors. Speed control.
- 1.3. Synchronous motors.
- 1.4. DC motors.

2. Hydraulic Actuators

- 2.1. Principles of hydraulics. Symblogy.

2.2. Hydraulic pumps.

2.3. Hydraulic cylinders. Hydraulic motors.

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 on the blackboard.
- **Resolution of problems:** Students solve problems individually during these sessions under the supervision of teachers of the subject.
- **Simulation:** design and simulation of hydraulic and pneumatic circuits using specific software.
- **Laboratory:** assembly and control of electrical, hydraulic and pneumatic circuits using the equipment available in the lab. It is imperative that students take the PPE indicated in each lab class and follow the risk prevention rules specified in each case.
- **Exam:** Two written tests are held during the semester. There is also a final retrieval test.

Development plan

Week	Methodology	Contents	Hours at classroom	Hours of autonomous work
1-3	Lectures Resolution of problems	1. Electric actuators	10	15
3-5	Lectures Resolution of problems	2. Hydraulic actuators	10	15
6	Simulation	2. Hydraulic actuators	4	6
7-8	Laboratory	1. Electric actuators	4	6
7-8	Laboratory	2. Hydraulic actuators	4	6
9	1st test of evaluation (exam)	1. Electric actuators 2. Hydraulic actuators	2	
10-14	Lectures Resolution of problems	3. Pneumatic actuators	12	18
14-15	Simulation	3. Pneumatic actuators	4	6
15	Laboratory	3. Pneumatic actuators	2	3
16-17	2nd test of evaluation (exam)	3. Pneumatic actuators	2	

19	Retrieval test	All the contents of the subject	2	
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Laboratory and simulation classes will be conducted in small groups.

Evaluation

Evaluation activities	%	Dates
PA 1. Written exam (units 1 and 2)	40	Week 9
PA 2. Written exam (unit 1)	30	Weeks 16-17
Practices: laboratory and simulation	30	Along the course
Retrieval exam	70	Week 19

Guidelines for evaluation of the subject.

Exams:

- In the 9th and 16/17th weeks the scheduled exams will be performed (PA1 and PA2). Exam PA1 has a weight of 40% and exam PA2 has a weight of 30% over the final grade of the course.
- To pass the course it is necessary at least a grade of 5 over 10 of the final grade and simultaneously, to have a grade equal to or greater than 3 of each of these exams (PA1 and PA2).
- In the 19th week it is possible to recover/improve the grade of the course by completing a written exam. The student may recover/improve the grade of the two partial exams or only recover/improve one exam. To pass the subject, it is necessary a grade of 5 over 10 of the final grade and simultaneously, to have a grade equal to or greater than 3 of the recoveries of each exam.

Practicals

- Throughout the course there will be different laboratory and computer practices. The practices grade represent the 30% of the final grade for the course.
- Attendance at laboratory practices and the delivery of corresponding reports is mandatory.
- The practices grade can not 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

Serrano A. 2011. *Neumática práctica*. Madrid, Paraninfo, 450 pp.

Pinches M.J., Ashby J.G. 1996. *Power hydraulics*. Sheffield Hallam Univ. Press, 400 pp.

3. Pneumatic Actuators

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

Deppert W., Stoll K. 1990. *Aplicaciones de la neumática*. Barcelona, Marcombo, 134 pp.

Deppert W., Stoll K. 1988. *Dispositivos neumáticos*. Barcelona, Marcombo, 188 pp.