



Universitat de Lleida

DEGREE CURRICULUM  
**MECHATRONICS II**

Coordination: Eduard Gregorio López

Academic year 2014-15

## Subject's general information

<b>Subject name</b>	MECHATRONICS II
<b>Code</b>	102137
<b>Semester</b>	2n Semester
<b>Typology</b>	Optional
<b>ECTS credits</b>	6
<b>Theoretical credits</b>	0
<b>Practical credits</b>	0
<b>Coordination</b>	Eduard Gregorio López
<b>Department</b>	Department of Agricultural and Forest Engineering
<b>Modality</b>	Presencial
<b>Important information on data processing</b>	Consult <a href="#">this link</a> for more information.
<b>Language</b>	Català
<b>Degree</b>	Degree in Mechanical Engineering / Degree in Automation and Industrial Electronic Engineering
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## Subject's extra information

This course presents the main types of hydraulic, pneumatic and electrical 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.

## Learning objectives

- Identify and understand the application of the main electrical machines used in the industry.
- Calculate the main electrical quantities in circuits with electric motors, generators and transformers.
- 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, 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:

- Applied knowledge to measurement systems and industrial actuators.
- Capacity to design and implement control and automation of mechanical systems.
- Applied knowledge to multibody and robotic mechanisms.

## Subject contents

### **PART I. Electric Actuators** (3 ECTS)

Principles of electrical machines - Induction motors - Synchronous motors - DC motors - Single phase and special use motors - Regulation and control of electrical machines - Transformers - Criteria for selection of the actuator.

### PRACTICALS

1. DC machines.
2. Asynchronous machines.
3. Synchronous machines and rotor with slip rings.
4. Three-phase transformers.

## **PART II. Hydraulic and Pneumatic Actuators** (3 ECTS)

### Hydraulics

Components of a hydraulic circuit. Symbology - Organization of circuits. - Fluids and hydraulic pumps. Classification. Gear pumps. Vane pumps. Piston pumps. Characteristic curves and performances - Actuators. Simple and double acting hydraulic cylinders. Cylinders in differential circuit. Calculation and selection of hydraulic cylinders - Hydraulic motors. Classification. Operating diagrams. Calculation and selection of hydraulic motors - Regulation and control elements. Directional valves. Pressure regulating valves. Flow control valves.

### Pneumatics

Production, processing and distribution of compressed air. Compressors - Symbology - Pneumatic actuators - Pneumatic valves - Design and operation of circuits. Sequential systems - Electrohydraulics, electropneumatics and automation of circuits - Proportional hydraulics and pneumatics.

### PRACTICALS

1. Control of a hydraulic circuit.
2. Design and simulation of circuits with *FluidSIM-H* and *FluidSIM-P*.
3. Control of a pneumatic manipulator.
4. Proportional control of hydraulic and pneumatic actuators.

## Methodology

See development plan.

## Development plan

Week	Unit
1	Electric actuators
2	Electric actuators
3	Electric actuators
4	Electric actuators Electric machines laboratory
5	Electric actuators Electric machines laboratory
6	Hydraulic actuators Electric machines laboratory
7	Hydraulic actuators
8	Hydraulic actuators
9	First evaluation
10	Hydraulic actuators

Week	Unit
11	Hydraulic actuators Hydraulic laboratory
12	Pneumatics
13	Pneumatics Pneumatics laboratory
14	Pneumatics Simulation of hydraulic, pneumatic and electric circuits.
15	Pneumatics Simulation of hydraulic, pneumatic and electric circuits.
16	Second evaluation
17	Second evaluation
18	Tutoring
19	Recovery

## Evaluation

Evaluation activities	%	Dates
PA 1. Written exam (block I: electric actuators)	45	Week 9
PA 2. Written exam (block II: pneumatics and hydraulics)	45	Weeks 16 i 17
Practicals (laboratory)	10	Along the course
Recovery written exam	90	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). Each of these exams has a weight of 45% over the final grade of the course.
- To pass the course it is necessary at least a grade of 5 over 10 of the average of the two written exams (PA1 and PA2) and simultaneously to have a grade equal to or greater than 3 of each of these exams.
- 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 blocks or of a single block. To pass the subject, it is necessary a grade of 5 over 10 of the average of the two blocks and simultaneously to have a grade equal to or greater than 3 of each of these blocks.

#### Practicals

- Throughout the course there will be different computer and laboratory practices. The practices grade represents 10% of the final grade for the course, of which 5% are practices of block I and the other 5% are practices of block II.
- 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

### **PART I. 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.

Jesús Fraile Mora y Jesús Fraile Ardanuy, 2005. *Problemas de Máquinas Eléctricas*. 6a edición, McGraw-Hill, 428 pp.

### **PART II. Hydraulic and Pneumatic Actuators**

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

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

Roldán J. 2001. *Prontuario de hidráulica industrial*. Madrid, Paraninfo, 231 pp.

Millán S. 1998. *Cálculo y diseño de circuitos en aplicaciones neumáticas*. Barcelona, Marcombo, 281 pp.

Gil J. 1998. *Elementos hidráulicos en los tractores y máquinas agrícolas*. 2ª edición, revisada y ampliada. Madrid, Ediciones Mundi-Prensa, 256 pp.

Roca F. 1997. *Oleohidráulica básica. Diseño de circuitos*. Barcelona, Edicions UPC, 247 pp.

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