



Universitat de Lleida

DEGREE CURRICULUM
MECHATRONICS II

Academic year 2015-16

Subject's general information

Subject name	MECHATRONICS II
Code	102137
Semester	2n Semester
Typology	Optional
ECTS credits	6
Theoretical credits	3
Practical credits	3
Office and hour of attention	To arrange with the professor
Department	Department of Agricultural and Forest Engineering
Teaching load distribution between lectures and independent student work	60 h lectures (40%) 90 h independent student work (60%)
Modality	Presencial
Important information on data processing	Consult this link for more information.
Language	Català / English (notes)
Degree	Degree in Mechanical Engineering / Degree in Automation and Industrial Electronic Engineering
Office and hour of attention	To arrange with the professor
E-mail addresses	egregorio@eagrof.udl.cat

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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. To follow this subject properly some previous knowledge/skills on electrical circuits is recommended.

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

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.

PART II. Hydraulic and Pneumatic Actuators

Hydraulics

Principles of hydraulics. Symbology. - Hydraulic pumps - Hydraulic cylinders - Hydraulic motors - Regulation and control elements. Valves - Hydraulic circuits.

Pneumatics

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

Methodology

The methodological axes are divided into:

- 1- Theoretical sessions. The professor will present the theoretical fundamentals of the subject.
2. Problem solving sessions. The professor resolves examples which apply the fundamentals presented in the theoretical sessions. Students also take an active part, individual solving application exercises or working in groups.
- 3- Laboratory. Students will practice with real electric, hydraulic and pneumatic actuator. Students will also practice with pneumatic and hydraulic simulation software.

Development plan

Week	Unit
1	Electric actuators
2	Electric actuators
3	Electric actuators
4	Electric actuators
5	Electric actuators Electric machines laboratory
6	Electric actuators Electric machines laboratory
7	Hydraulic ad pneumatic actuators
8	Hydraulic and pneumatic actuators Electric machines laboratory
9	First evaluation
10	Hydraulic ad pneumatic actuators
11	Hydraulic ad pneumatic actuators
12	Hydraulic ad pneumatic actuators Hydraulic ad pneumatic laboratory
13	Hydraulic ad pneumatic actuators Hydraulic ad pneumatic laboratory
14	Hydraulic ad pneumatic actuators
15	Hydraulic ad pneumatic actuators Hydraulic ad pneumatic laboratory
16	Second evaluation

Week	Unit
17	Second evaluation
18	Tutoring
19	Recovery

Evaluation

Evaluation activities	%	Dates
PA 1. Written exam (block I: electric actuators)	40	Week 9
Practicals - block I (laboratory)	10	Weeks 1-8
PA 2. Written exam (block II: pneumatics and hydraulics)	40	Weeks 16 i 17
Practicals - block II (laboratory)	10	Weeks 10-15
Recovery written exam	80	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 40% 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.

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.