DEGREE CURRICULUM

MECHATRONICS I

Coordination: POMAR GOMA, JESUS

Academic year 2016-17

MECHATRONICS I 2016-17

Subject's general information

Subject name	MECHATRONICS I
Code	102136
Semester	1st Q(SEMESTER) CONTINUED EVALUATION
Typology	<table><tr><th>Degree</th><th>Course</th><th>Typology</th><th>Modality</th></tr><tr><td>Bachelor's Degree in Automation and Industrial Electronic Engineering</td><td>4</td><td>OPTIONAL</td><td>Attendance-based</td></tr><tr><td>Bachelor's Degree in Mechanical Engineering</td><td>4</td><td>OPTIONAL</td><td>Attendance-based</td></tr></table>
ECTS credits	6
Groups	1GG,3GP
Theoretical credits	0
Practical credits	0
Coordination	POMAR GOMA, JESUS
Department	ENGINYERIA AGROFORESTAL
Important information on data processing	Consult this link for more information.
Language	Català Multilingual teaching material: (Català, Castellà, English)
Office and hour of attention	Flexible. On demand.

MECHATRONICS I 2016-17

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
ESCOLÀ AGUSTÍ, ALEXANDRE	aescola@eagrof.udl.cat	3,1	
LLORENS CALVERAS, JORDI	jordi.llorens@aegrof.udl.cat	1,2	
POMAR GOMA, JESUS	pomar@eagrof.udl.cat	3,7	

Subject's extra information

Mechatronics is a recent concept that is born of a synergistic integration of the areas of mechanics, electronics and computer science giving birth to mechatronic systems. The optional block on Mechatronics (Mechatronics I, II and III) provides knowledge about the technology and required tools to address the need to automate both machines and industrial manufacturing processes in order to design and implement equipment and production processes, agile, efficient and reliable that respond to modern industry. Specifically, **Mechatronics I** deals with the key elements for the design and implementation of automatic control with an applied focus, contemplating:

1. physical components: sensors and transducers;
2. computer hardware and electronic components;
3. logical components related to the design and programming of systems to process information, and
4. the integration of all of them for the implementation of real systems.

Learning is done through the resolution of case studies, simulation and experimentation with real systems.

Learning objectives

1. To provide with the technological basis that supports the automation and control equipment and industrial processes based on ICT.
2. Introduce the basic elements that constitute a system of automatic control of the mechatronic field.
3. Introduce and apply sensors and transducers as devices for automatic data acquisition.
4. Introduce and apply the methodology of designing and implementing computer-supported automatic control systems and industrial automation.
5. Introduce and apply techniques prototyping, simulation and virtual instrumentation to facilitate the implementation of real systems.
6. Applying the knowledge gained in the implementation of real projects automatic control and automation.

Competences

Basic Competences

GEEIA28. Applied knowledge of industrial computing and communications.

GEEIA29. Capacity to design systems of industrial automation control.

Specific competences

GEEIA-EPS31. Applied knowledge to measurement systems and industrial actuators.

GEEIA-EPS32. Capacity to design and implement control and automation of mechanical systems.

Subject contents

Module 0. Mechatronics and Mechatronic Systems.

Basic definitions. Key elements. Present and future. Development and educational organization of the optional block on Mechatronics.

Module 1. Technological basis of automation and equipment control and industrial processes.

1.1. Introductory concepts. Automatisms and automation. Concept of process and control actions based on ICT. Bases of automatic control: (1) measuring physical variables; (2) data processing and (3) generating control signals. Application of digital systems to the implementation of automatic control. Automatic control systems with intelligent behaviour. Examples.

1.2. Sensors and Transducers: devices to measure physical phenomena. Concepts. Classification. Signals types. A/D and D/A converters. Signal conditioning. Precision and Accuracy. Origin and types of errors. Calibration. Sensors frequent use in industrial automation.

Workshop 1. Experimenting with sensors

1.3. Electronic process control. Concept of process control and industrial processes. Types of control systems. Open and closed loop systems. Bases of automation and automatic process control. Automatic control actions. PID control: proportional, integral and derivative actions.

1.4. Automatic control systems. Main hardware components: sensors, actuators and digital controllers. Major hardware systems: (1) PC-based systems, (2) PLC-based system (programmable logic controllers, (3) Programmable automation controllers PAC), and (4) Microcontrollers. Distributed systems. Networks, communication buses and data transmission. Applications.

Module 2. Design and Implementation of automatic control systems

2.1 Control by digital logic. Logic functions: deduction and reduction. Combinational and sequential circuits. Automation with integrated circuits. Prototyping with integrated circuits.

Workshop 2A. Automation and control of a water supply system using digital logic and integrated circuits

2.2. Control by PLCs. Types of PLC. Programming languages. Features. Solving a case study.

Workshop 2B. Automation and control of a water supply system using PLC

2.3. Control by computerized electronic systems
Bases of computer programming control systems and automation. Progress and next-generation programming languages. Software: concepts, data and variables and structures to support computerized process. Visual programming and graphical programming. Virtual instrumentation. "G" programming language. Programming methodologies for control systems. Storage and data recovery: creating reusable code. Code libraries. Debugging techniques and tools. Resolution of case studies of monitoring and control.

Workshop 3. Characterization and control of a thermoelectric heat pump

2.4. Techniques for the design and implementation of control systems. Analysis of applications. Structuring, modularization and other techniques. The concept of fundamental programming structures. Implementation of formulas and equations. Applying the methodology of incremental development. Development of a first project.

Workshop 4. Design of a system for automatic weighing

2.5. Development of control systems. Requirements analysis and incremental prototyping. Learning by developing real applications. Integration of hardware and software components. Buses and communications between devices. Project development.

Workshop 5. Speed ??control of a motorized system

Module 3. Integration of technologies: project realization.

Solving a problem and proposal of an automation project. Project development phases: requirements analysis; system design; implementation.

Evaluation

Activity type	Procedure	Weight (%)
Resolution of problems and cases based on contents given during the lectures and workshops.	Delivery of solved cases	**20**
Experimental workshops at the laboratory	Delivery of reports on the workshop	**35**
Automation project	Delivery of a complete report, the process control software and oral presentation of the project	**45**
Technical visits		
Total		**100**