### 16229 - MECT-U3P07 - Mechatronics

<table>
<thead>
<tr>
<th>Coordinating unit:</th>
<th>340 - EPSEVG - Escola Politècnica Superior d'Enginyeria de Vilanova i la Geltrú</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching unit:</td>
<td>707 - ESAII - Department of Automatic Control</td>
</tr>
<tr>
<td></td>
<td>710 - EEL - Department of Electronic Engineering</td>
</tr>
<tr>
<td></td>
<td>712 - EM - Department of Mechanical Engineering</td>
</tr>
<tr>
<td>Academic year:</td>
<td>2012</td>
</tr>
<tr>
<td>Degree:</td>
<td>(ENG) ENGINYERIA EN AUTOMATICA I ELECTRONICA INDUSTRIAL (Syllabus 2003). (Teaching unit Optative)</td>
</tr>
<tr>
<td>Credits:</td>
<td>6</td>
</tr>
<tr>
<td>Teaching languages:</td>
<td>Catalan, Spanish, English</td>
</tr>
</tbody>
</table>

#### Teaching staff

| Others:            | Luis Miguel Muñoz Morgado                                                    |

#### Learning objectives of the subject

The objective is to enable the student to integrate the acquired knowledge of the diverse skilled branches of engineering to the Degree: mechanics, electronics, computer science and control. During the course a mechatronics project will be designed, constructed, evaluated and documented.
## Content

### Presentation

**Description:**
Contents
- Demonstration of mechatronics devices
- Basic specifications of the mechatronics project that we will realize during the course.
- To determine the proportions main elements structures mechanics.
- Kinematic and dynamic basic calculations.

### Steps toward a mechanical design

**Description:**
Contents
- Exposition of a part of the design that we will realize.
- Work of the students in group: to outline the raised design and to limit considering it the specifications, the process of manufacture and the later assembly.

### Definitive design

### Modelling of the selected design

### CAD/ CAM

**Description:**
Contents
- Demonstration of UNIGRAPHICS module CAM.
- Turning of some from the pieces to the manufacture factory.
- Assembly of the mechanical set
Electronic elements. General concepts

**Description:**
Contents
- Electronic elements. General concepts
- Liabilities: condensing resistance and coils.
- Basic semiconductors: diodes, transistors and op amps.
- Special devices: semiconductors of power and other integrated circuits.
- Characteristics of the more excellent electrical signals.
- Discussion of the characteristics of the most excellent Datasheet: small signal versus. Great signal, concept of bandwidth, etc.
- Processes of manufacture of electronic circuits.
- Processes and techniques used in the manufacture of printed circuits.
- Advice for the weld and assembly of electronic prototypes.
- Recent SMD and other technologies.

Activities, knowledge, abilities, aptitudes
At the end of this meeting, the student will have learned the practical usefulness of the main elements that may have electronic circuits to cope with its design and manufacturing processes of the same

Computer science tools of electronic design

**Description:**
Contents
- Process of electronic design: graphical design (SCH), simulation (Spice) and drawn up of tracks (PCB)
- Software of electronic design.

Activities, knowledge, abilities, aptitudes
When finalizing this session the student will have become familiar with the software of electronic design that will use for the implementation of the electronic devices that will be used in the mechanical structure.
### Electronicses that interact with the surroundings

**Description:**
- Contents
  - The sensors and actuators in the mechanical systems. Classification of sensors and actuators.
  - General and specific characteristics for the selection of the sensor/suitable actuator.
  - Preparation of sensors and actuators
  - Other special devices: Video cameras, CD's among others.
  - Election of sensors and actuators.

**Activities, knowledge, abilities, aptitudes**
This session is destined to the electronic elements that have more relation with the world of mechanical engineering and which, somehow, they are used to interact with this type of systems, or taking information or acting in its physical surroundings. When finalizing this session the students must be able to interpret the most important characteristics of the sensors/actuators that must bring to him to make the possible most optimal selection of these. At the same time one provides the basic knowledge to them to be able to make his preparation.

### Aspects on special microcontrollers and other devices

**Description:**
- Contents
  - Practical examples of integration of electronic circuits in mechanical systems. Mechanical systems.
  - Robotics
  - Hydraulics
  - Etc.

**Activities, knowledge, abilities, aptitudes**
In this session the student will acquire the general knowledge necessary to be able to implement structures physically based on microprocessor that, a priori, has collected the data of the sensor and must provide the signal corresponding to the actuator.
On the other hand, and by means of examples, he tries himself to make the student reflect on aspects of electronic design that condition to three engineering in the development of projects in mechatronics: mechanics and control.

### Implementation of the electronic system

**Description:**
- Activities, knowledge, abilities, aptitudes
This session is destined to debate the proposals presented to choose that one that is more optimal and to let the whole system ready to implement the algorithm that controls the kinematic behaviour of the same.
Modelling and syntony of controller

Description:
Contents
Of the theoretical model to the real model. To identify and to obtain the parameters and ranks of values necessary to be able to control the system.

Specifications. To return to review the initial specifications of the system and their agreement or discrepancy with the characteristics and nonlinearities of the model.

Syntony of controller. From the model of the system the type of suitable control will be selected but.

Activities, knowledge, abilities, aptitudes
In this session the students will get the parameters characterizing the system as well as the ranks of operating sensors and actuators on the study of the mechanical and electronics
From this model will be designed driver of the variables of interest and control structure

Control and errors

Description:
Contents
Digital control. Study of the stages of the control and creation of the algorithm differences that the designed control will implement to be able to be executed to the microprocessor.

Errors and purification. Syntony and minimization of the errors and disturbances nonconsidered initially that cause that the system moves away of the initial specifications.

Activities, knowledge, abilities, aptitudes
In this session the students will have to obtain the discretizadas equations of the continuous algorithms. The equations will suitably implement to the microcontroller structuring the stages of control within the period of sampling.

Control at low level

Description:
Contents
Control in low level. Development of algorithms of control of variables in low level: position, speed, pair.

Activities, knowledge, abilities, aptitudes
In this session the students will be design and develop the algorithms that are allowed them to realize movements with trajectories predefinides
Integration

Description:
Objectives
Beginning of a mechatronic system.

Qualification system

Evaluation of the Project (45%)
Individual presentation (25%)
Evaluation Laboratory (30%)

Bibliography

Basic:


Complementary: