Introduce the students to the techniques of analysis and design of feedback control systems that involve both the specification and use of sensors and actuators, and communication systems that link sensors, controllers and actuators. Students will be able to apply the technologies of sensors, actuators and where appropriate communication systems in applications and examples of control systems. This includes the specification of the characteristics required for sensors, actuators and communication systems. Students will be able to use tools and methods of analysis and technology assessment of the sensors, actuators and communication systems for control. The student will be able to assess the difficulty of using the required technology for controlling certain plants and implementing the developed controllers.

## Study load

<table>
<thead>
<tr>
<th>Total learning time: 112h 30m</th>
<th>Hours large group: 27h 24.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours small group: 13h 30m 12.00%</td>
</tr>
<tr>
<td></td>
<td>Guided activities: 0h 0.00%</td>
</tr>
<tr>
<td></td>
<td>Self study: 72h 64.00%</td>
</tr>
</tbody>
</table>

## Teaching methodology

Concepts, encouraging the active participation of students.

In practical classes in the laboratory, the teacher will propose pre-projects that require the use of the knowledge gained in the field of control technology and for the actuators and sensors to design prototypes that have capacities as controlled systems.

## Learning objectives of the subject

Introduce the students to the techniques of analysis and design of feedback control systems that involve both the specification and use of sensors and actuators, and communication systems that link sensors, controllers and actuators.

Students will be able to apply the technologies of sensors, actuators and where appropriate communication systems in applications and examples of control systems. This includes the specification of the characteristics required for sensors, actuators and communication systems. Students will be able to use tools and methods of analysis and technology assessment of the sensors, actuators and communication systems for control. The student will be able to assess the difficulty of using the required technology for controlling certain plants and implementing the developed controllers.
## 1. Introduction to the control systems technologies.

**Learning time:** 4h  
Guided activities: 4h

**Description:**  
Technological evolution. Analog Control. Computer control. Elements of a control system. Sensors, actuators, controllers, interfaces. Communications systems and interconnections. To determine the actual structure of the components of the control systems in industrial applications and in other social settings. Knowing the technological, economic and security implementation of control systems.

**Specific objectives:**  
To know the actual structure of the components of the control systems in industrial application and other social settings. To know the technological, economic and security implementing control systems limitations.

## 2. Measurement and instrumentation

**Learning time:** 6h  
Guided activities: 6h

**Description:**  
Basic principles of measurement systems. Static characteristics of instruments: Linearity, resolution, accuracy, hysteresis. Physical principles of operation of the sensors and actuators. Introduce the abstract structure of the measurement and detection of physical parameters systems. Analyze common structures for adapting the physical parameters to electrical signals. Define the static and dynamic characteristics of the sensors as a system and their effects on the acquired signal. Exposing the abstract model of the control actuators.

**Specific objectives:**  
To introduce the abstract structure of the measuring systems and detection of physical parameters. Analyzing common structures adaptation of the physical parameters into an electrical signal. Define the static and dynamic sensors as a system and its effects on the acquired signal characteristics. Exposing the abstract model of the actuators and actuators for controlling

## 3. Structure and characteristics of the transducers

**Learning time:** 8h  
Guided activities: 8h

**Description:**  
Sensors for measuring mechanical quantities, mainly in the field of robotics: position, velocity, acceleration. Sensors for the process industries: pressure, temperature, flow, pH. Actuators: Servo motors, DC, AC and Step motors, hydraulic and pneumatic positioners, servo valves, cylinders and pumps. Transmitters, intelligent sensors and actuators (Smart). Describe the significant parameters in sensors and actuators, describe the operation of the bridge circuit and configurations with multiple connections, describe and specify sensors and actuators for different magnitudes and different environments indicate typical power sources for the actuators, show the structure of intelligent sensors and actuators.
### 4. Industrial communication systems

**Learning time:** 8h  
Guided activities: 8h

**Description:**  
Fundamentals of communications. Open interconnection model. Field buses and buses of sensors and actuators. Operating characteristics. Network evaluation models. The bus CAN (Control Area Network). Know the basics of communication systems. How communication networks adapt to industrial needs. Knowing the physical, link, application and user layers of industrial networks. Analyze the specificities of fieldbuses. Learning to assess the capabilities of networks in control applications. Meet one of the most common fieldbus, CAN.

### 5. Practical application and dedicated systems

**Learning time:** 8h  
Guided activities: 8h

**Description:**  

### Qualification system

Rating of the students will be based on the outcome of each of the activities taking place. So after each activity you will have a mark.  
The final grade will be the arithmetic average of the marks for each activity

### Bibliography

- 4. Industrial communication systems  
- 5. Practical application and dedicated systems