Mechatronics is an engineering discipline to study the synergistic combination of mechanical engineering, electronics engineering, control engineering, and computer engineering.

This course covers the fundamental areas of science and technology on which a mechatronics design is based. This includes mathematical modeling of complex dynamical systems, analysis of mathematical models using computer simulations, measurement systems (sensors and signal conditioners), actuators, continuous-time controller design and its real-time digital implementation, and networked control systems. The focus is on the role of each of these areas in the overall design process and how these key areas are integrated to form a successful mechatronics system design.

The instructional objectives are:
- To enable students understanding the modern mechatronics components.
- To present the underlying principles and alternatives for mechatronics systems design.
- To provide students with hands-on experience of mechatronics technology for diverse applications.
- To develop the student's ability to evaluate appropriate technology and devise realistic industrial systems.
## Study load

<table>
<thead>
<tr>
<th></th>
<th>Hours large group:</th>
<th>Hours medium group:</th>
<th>Hours small group:</th>
<th>Guided activities:</th>
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<tr>
<td><strong>Total learning time:</strong></td>
<td>150h</td>
<td>45h</td>
<td>0h</td>
<td>15h</td>
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<td>30.00%</td>
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<td>10.00%</td>
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<td>Content</td>
<td>Learning time:</td>
<td>Description:</td>
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</tbody>
</table>
| 1. Course Presentation                      | 10h            | Theory classes: 2h  
Laboratory classes: 2h  
Self study: 6h                  |
| **Description:**                             |                | 1.1 Course contents and syllabus.  
1.2 Involved projects - Description.  
1.3 Rules and timetable.                        |
| 2. Introduction to Mechatronics Systems Design | 20h            | Theory classes: 4h  
Laboratory classes: 4h  
Self study: 12h               |
| **Description:**                             |                | 2.1 Components of mechatronics systems.  
2.2 Motion control systems.  
2.3 Servomotors, Stepper Motors, and Actuators for Motion Control.  
2.4 Stationary and Mobile robots.  
2.5 Linkages: Drives and Mechanisms.  
2.6 System integration.                       |
| 3. Dynamic systems Modelling.               | 30h            | Theory classes: 6h  
Laboratory classes: 6h  
Self study: 18h               |
| **Description:**                             |                | 3.1 Example of Models.  
3.2 Principles of Physical modelling.  
3.2 Parameters identification.  
3.3 Model simulation.                         |
# 4. Control System Design.

**Learning time:** 40h  
Theory classes: 8h  
Laboratory classes: 8h  
Self study: 24h  

**Description:**  
4.1 Controllers types.  
4.2 Design in Time Domain.  
4.3 Design in frequency.

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# 5. ARM-based Microcontrollers.

**Learning time:** 30h  
Theory classes: 6h  
Laboratory classes: 6h  
Self study: 18h  

**Description:**  
5.1 ARM Cortex-M0+ Processors.  
5.2 Interrupts and Low Power Features.  
5.3 CMSIS and peripherals.

---

# 6. From the System to the microcontroller.

**Learning time:** 20h  
Theory classes: 4h  
Laboratory classes: 4h  
Self study: 12h  

**Description:**  
6.1 Code generation for embedded applications.  
6.2 Code generation from MATLAB/SIMULINK to C/C++.  
6.3 Workflow for code generation.  
6.4 Optimization Strategies  
6.5 Controlling C Code Style.  
6.6 Deploy and Test Executable Program.
295902 - ISCA - Implementation of Automatic Control System

**Qualification system**

The final course mark is based on four evaluations:

1. Description and scope of the work (20%).
2. Development and evolution of the work during the course (25%).
3. Project Presentation (25%).
4. Technical report (30%).

According to the specific EEBE academic regulations, sections 2.2.b and 2.2.c, this subject is considered as continuous assessment methodology and, therefore, is not subject to reevaluation.

**Bibliography**

**Basic:**


