Last update: 14-07-2017

295902 - ISCA - Implementation of Automatic Control System

Coordinating unit: 295 - EEBE - Barcelona East School of Engineering
Teaching unit: 707 - ESAII - Department of Automatic Control
Academic year: 2017
Degree: BACHELOR'S DEGREE IN MATERIALS ENGINEERING (Syllabus 2010). (Teaching unit Optional)
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Teaching unit Optional)
BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Teaching unit Optional)
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Teaching unit Optional)
BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Teaching unit Optional)
ECTS credits: 6 Teaching languages: Catalan, Spanish

Teaching staff

Coordinator: Calomarde Palomino, Antonio

Others: Tornil Sin, Sebastian

Opening hours

Timetable: It will be notified at the beginning of the semester.

Prior skills

It is convenient to have passed the subjects of the previous levels.

Teaching methodology

ISCA is based on practical learning, through the development of a project that will be designed during the course.

This course studies Automatic Control and mechatronics at a practical level; theory is presented wherever necessary but is not emphasized. More emphasis is placed on physical understanding rather than on mathematical formalism. Several practical examples are discussed throughout the course; one of them forms the basis for a final project.

Learning objectives of the subject

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.

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Study load

Total learning time: 150h	Theory classes:	45h	30.00%
	Practical classes:	0h	0.00%
	Laboratory classes:	15h	10.00%
	Guided activities:	90h	60.00%

Content

1. Course Presentation	Learning time: 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.	Learning time: 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.	Learning time: 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.

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.

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:

Sclater, Neil ; Chironis, Nicholas P. Mechanisms & mechanical devices sourcebook. 5th. New York [et al.]: McGraw Hill Education, 2001. ISBN 0071361693.

Ljung, Lennart; Glad, Torkel. Modeling of dynamic systems. Englewood Cliffs: PTR Prentice Hall, 1994. ISBN 9780135970973.

Nise, Norman S. Control systems engineering. 7th. Wiley, ISBN 9781118170519.

MATLAB Embedded Coder. User's guide [on line]. [Consultation: 14/09/2017]. Available on: <https://rophoenixmakerevolution.files.wordpress.com/2015/09/eml_ug.pdf>.

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