Universidad Zaragoza

Academic Year/course: 2022/23

29851 - Industrial Electronics

Syllabus Information

Academic Year: 2022/23
Subject: 29851 - Industrial Electronics
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
Degree: 440 - Bachelor's Degree in Electronic and Automatic Engineering
ECTS: 6.0
Year: 4
Semester: Second semester
Subject Type: Optional
Module:

1. General information

2. Learning goals

3. Assessment (1st and 2nd call)

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

This course is organized under the Project-Based Learning (PBL) approach. From the beginning, students must develop an experimental project related to Industrial Electronics. This project requires several previous skills and knowledge in the field of Programmable Electronic Systems, Power Electronics, Instrumentation and Automatics. Complementary skills and knowledge on the modeling, simulation and control of electrical machines and mechatronic systems is provided along the course.

The development of the electrical traction of a four-wheel vehicle is an example of such a project. The vehicle is a 1/10 scale off-road buggy powered by a permanent magnet three-phase synchronous motor. The challenge of the project is simple: the vehicle must cover a distance of 4 meters as fast as possible observing a maximum acceleration and deceleration level. The acceleration and deceleration levels are monitored by a ball-ramp system. Students must develop the kinematic and dynamic model of the vehicle, they must work on the electromagnetic model of the motor, they must understand the basics of the programming of real-time control of motors and, finally, students ought to improve their skills on the experimental tuning of control loops.

The learning-teaching process takes place in three areas:

- In the classroom: the lecturer will explain the project to be developed and the milestones to be achieved. Part of the work will be carried out in the classroom. At each development step, the students will show their proposals to the entire class and after an open discussion phase, the best-suited solution will be retained as the basis for future developments.
- At the laboratory: students will implement and validate experimentally previously proposed developments.
- Personal homework: in groups of two, three or four persons, students will work on the achievement of the required milestones.

4.2. Learning tasks

The course includes the following learning tasks:

IN-PERSON ACTIVITIES: 2.4 ECTS (60 hours)

1) Classroom activities (type T1) (30 hours)

Theoretical and practical contents will be explained. The lecturer will show the fundamentals and basic concepts of the required knowledge in order to achieve the milestones of the project. Each concept will be explained close to the moment where it is required.

2) Problem and case-solution activities (type T2) (15 hours)

This activity will turn around the problems and issues raised by the achievement of each milestone. The solution to these problems and any related work will be carried out in groups.

3) Laboratory work (type T3) (15 hours)

Students will implement and test the experimental validity of the solutions they have developed.

NOT IN-PERSON ACTIVITIES: 3.6 ECTS (90 hours)

4) Demanded works (type T6) (64 hours)

The lecturer will ask to carry out some works related to several milestones aligned with the project to be developed. This activity can be done individually or in groups.

5) Self-study (type T7) (20 hours)

Personal work of each student in order to achieve a comprehensive knowledge of the concepts and methods required on the achievement of the milestones of the project.

6) Assessment activities (type T8) (6 hours)

The assessment will be done based on the degree of achievement of the different milestones of the project.

4.3. Syllabus

The course will address the following topics:

1. Specifications and requirements in Industrial Electronic applications.
2. Mechatronic systems: fundamentals, modeling and simulation.
3. Modeling of the Permanent Magnet Synchronous Motor (PMSM)
4. Vector control of the PMSM
5. Power electronic systems for the control of three-phase electrical machines.
6. Programming of the real-time control of the PMSM on a microcontroller.
7. Modeling and simulation of power electronic systems
8. Experimental integration of power electronic systems, microcontrollers and actuators
9. Control of the exchange of the energy with the three-phase line

4.4. Course planning and calendar

Classroom and laboratory activities will be held according to the timetable published by the Faculty of Engineering.

The lecturer will inform about the timing of the tutorship sessions.

Other activities will be planned according to the number of students and will be published on http://moodle.unizar.es