Universidad Zaragoza

Academic Year/course: 2023/24

60805 - Advanced Control and Electronic Implementation

Syllabus Information

Academic year: 2023/24
Subject: 60805 - Advanced Control and Electronic Implementation
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
Degree: 532 - Master's in Industrial Engineering
ECTS: 6.0
Year:
Semester: 532-First semester o Second semester
266-First semester o Second semester
107-Second semester
Subject type: Compulsory
Module:

1. General information

This subject offers an integrating vision, where the advanced techniques of two disciplines are developed: control and design of electronic systems based on analogue, digital and power circuits. The basic applications and functions of each discipline are discussed, a control design based on a real problem is introduced and an overview of the electronic implementation of control techniques in a circuit is given.

This subject is part of and completes the overview of electronics (digital and analogue branches) and control theory that started with the fundamental subjects of control and electronics.

The approach and objectives of the subject are aligned with some of the Sustainable Development Goals, SDGs, of the 2030 Agenda(https://www.un.org/sustainabledevelopment/es/) and certain specific targets. These objectives and goals are the following:

- Goal 3, Objective 3.6
- Goal 7, Objective 7.3
- Goal 8, Objective 8.2
- Goal 9: Objective 9.4

2. Learning results

Upon completion of this subject, the student will be able to:

- Develop an electronic project with the specification, design, assembly and documentation parts of a project.
- Build blocks using analogue, digital and power circuits. Verify them in the laboratory.
- Know the basic regulations and how to draft the documents associated with an electronic project.
- Know and know how to apply computer control design techniques for multi-variable systems.
- Know and know how to apply state-space and observer-based analysis and design techniques.
- Know and apply dynamic systems identification techniques to extract models of real systems, and simulate their behaviour.
- Know how to design a control architecture of a complex system and choose the appropriate technology for each component by applying the associated standards.

3. Syllabus

The contents developed to cover the advanced control competencies are:

- Modelling of systems with internal description.
- Continuous and sampled multivariable systems
- Stability. Controllability and observability.
- Linear control based on internal description.
- Observers. Control design with variable estimation.
- Non-linear control.

The contents developed to cover the advanced electronic design competencies are:

- Top-Down methodology for electronic design.
- Prototyping techniques in digital and analogue systems.
- Implementation of control systems in electronic circuits (instrumentation, A/D conversion, hardware implementation in microprocessors).

- Documentation and debugging of an electronic design.

4. Academic activities

THEORY-PRACTICE: (66 classroom hours)

1) Lecture (45h). It includes theoretical and problem-solving classes. The student will be encouraged to work on the problems in advance.

2) Laboratory practices (15h). Study and implementation of electronic circuits and integration of the corresponding control algorithm.

3) Assessment tests (6h)

AUTONOMOUS WORK: (84 hours)

1) Teaching assignments (24h). Creation of the proposed design that will include simulation, control algorithm designs and subsequent implementation in a low-cost programmable device.

2) Personal study (60h). Exercises and proposed cases to be developed, some of them to be solved in the classroom.

5. Assessment system

The student will be able to choose between two types of assessment:

1. CONTINUOUS ASSESSMENT

Three blocks of the subject will be evaluated:

1. Three milestones associated with theory and problems (80% of the grade) (*). Each milestone will have an electronics part and a control part. Minimum grade in each part of each milestone: 3 out of 10.
2. Five practice tests (20% of the grade)(*). During the realization of the practice itself. Minimum grade in each test: 3 out of 10.
3. A defence of the practical work of the subject. This part is optional. There will be an oral and individual defence of the work. Minimum grade: 3 out of 10.

The milestones and practice tests will preferably consist of questionnaires on Moodle that may include multiple choice questions, matching, numerical calculation and/or open-ended questions. These tests will be conducted solely and exclusively in person.

If the student does not obtain a grade higher than or equal to the minimum grade in any of the indicated tests, then they does not pass the CONTINUOUS ASSESSMENT.

(*) IMPORTANT: If the defence of the work is not performed, the sum of the grades of the milestones and the practice will not exceed 7. If the defence of the work is performed and passed (grade > 5 out of 10) there is no upper limit in the final grade and it can be raised up to 4 extra points.

2. ASSESSMENT BY GLOBAL TEST

It will consist of a written exam (80% of the grade) that will include all the theoretical contents/problems/practices that have been addressed during the term, and an oral/written test in the laboratory (20%) related to the practices performed.

On the other hand, the second evaluation call will be carried out through a comprehensive test conducted in the period established for this purpose in the academic calendar.