Electronic and industrial instrumentation systems

Academic Year: (2022 / 2023) **Review date: 29-04-2022**

Department assigned to the subject: Electronic Technology Department

Coordinating teacher: SAN MILLAN HEREDIA, ENRIQUE

Type: Compulsory ECTS Credits : 6.0

Year : 1 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

- Fundamentals of electronics
- Fundamentals of control engineering

OBJECTIVES

Ability to design electronic and industrial instrumentation systems. The key objectives of the course are:
- Provide principles and practices in the management of measuring instruments.
- Learn the basics of analog and digital signals processing.
- Know the components of data acquisition systems: signal conditioning, A / D converters and D / A, memory and digital processors.
- Know the means and systems for data communication in industrial instrumentation environments.

DESCRIPTION OF CONTENTS: PROGRAMME

1. INTRODUCTION
1.1 Introduction to electronic systems.
1.2 Introducción to industrial instrumentation systems.

2. MICROCONTROLLER SYSTEMS
2.1 Digital systems review (Data representation, registers, counters, architectures).
2.2 Introduction to microcontrolers.
2.3 Architecture of the reference microcontroller: CPU + peripherals.
2.4 Configuring inputs and outputs (analog and digital).
2.5 Timers. Time capture and signal generation.
2.6 Description of programs using flowcharts.

3. ANALOG ELECTRONIC SYSTEMS
3.1 Review of signals and systems. Frequency response of RLC circuits.
3.2 Amplification and characteristics of amplifiers: circuits with operational amplifiers. Differential amplifiers. Applications.
3.4 Filtering and filter types. Transfer function of first and second order filters. Filter circuits.
3.5 Instruments for measuring analog signals.

4. DIGITAL ELECTRONIC SYSTEMS
4.1 Description of discrete signals and systems.
4.2 Sampling of signals.
4.3 Signals quantification and coding.
4.4 Sample and hold circuits, AD converters and DA: Features.
4.5 Introduction to digital system processing.

5. INDUSTRIAL INSTRUMENTATION SYSTEMS
5.1 Sensors. Static and dynamic characteristics of sensors.
5.2 Conditioning circuits. Wheatstone bridge.
5.3 Examples and practical documentation of sensors and amplifiers for instrumentation.
5.4 Data acquisition cards and instrumentation SW (LabVIEW).
5.5 Communication buses in industrial instrumentation systems.
5.6 Instrumentation systems with microcontrollers. Practical cases.

LEARNING ACTIVITIES AND METHODOLOGY

Six theory/practice problems sessions plus a lab session per thematic block.
Lab project (four lab sessions).

ASSESSMENT SYSTEM

The weight of each evaluation activity is:
Practices: 15%
Project: 10%
Midterm exam: 30%
Final exam: 45% (minimum mark 4 points)

In the extraordinary examination there are two options: same weights and requirements as in the ongoing evaluation, or 100% of the mark of the final make-up exam.

% end-of-term-examination:	45
% of continuous assessment (assigments, laboratory, practicals…):	55

BASIC BIBLIOGRAPHY

- Miguel A. Pérez García Instrumentación electrónica , Paraninfo, 2014
- Richard S. Figliola Theory and design for mechanical measurements , John Wiley & Sons, 1995
- Tattamangam R. Padmanabham Industrial instrumentation: Principles and Design , Springer, 2000
- Thomas E. Kissell Industrial electronics , Prentice Hall, 2000