| | | | |
|---|---|---|---|
| Course Unit | Electronic Instrumentation and Measurements | Field of study | Electronics and Instrumentation |
| Bachelor in | Electrical and Computers Engineering | School | School of Technology and Management |
| Academic Year | 2023/2024 | Year of study | 2 |
| Level | 1-2 | ECTS credits | 6.0 |
| Type | Semestral | Semester | 1 |
| Code | 9112-742-2104-00-23 | | |

| Workload (hours) | 162 | Contact hours | T | TP | PL | TC | S | E | OT | O |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 15 | 15 | 30 | - | - | - | - | - |

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other

Name(s) of lecturer(s): João Paulo Coelho

## Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:
1. Estimate errors in measurement systems;
2. Design electromechanical measurement systems for the principal electrotechnic variables;
3. Understand the concept of transducers;
4. Analyse the behaviour of typical signal conditioning circuits;
5. Understand the behaviour of sample and hold circuits;
6. Understand the operation of the major A/D and D/A data conversion systems.

## Prerequisites

Before the course unit the learner is expected to be able to:
AC and DC circuit analysis

## Course contents

Metrology and characterization of the measure chain. Electromechanical measurement systems. Sensors and transducers. Signal conditioning circuits.

## Course contents (extended version)

1. Metrology and characterization of the measure chain
   - Interference and disturbances
   - Error propagation in measurement chains
2. Electromechanical measurement systems
   - Electromechanical measurement devices
   - Measurement of tension, courant and electric resistance
   - Errors in analog and digital instrumentation
3. Sensors and transducers
   - Passive sensors
   - Active sensors
   - Digital sensors
4. Signal conditioning
   - Impedance/tension conversion
   - Amplification
   - Filtering
   - Data conversion

## Recommended reading

1. J. P. COELHO, Sensores e Actuadores – Material de Apoio às Aulas. Instituto Politécnico de Bragança – ESTiG (2003/2005);
2. PALLÁS-ARENY and WEBSTER, Sensors and Signal Conditioning, ISBN 0-471-54565-1. John Wiley & Sons, Inc. (1991);
3. ASCH, G. et. al. Les Capteurs en Instumentation Industrielle. ISBN 2-04-016948-2 Dunod (1987);
4. JOHNSON e HILBURN, Rapid Practical Design of Active Filters, 1973;
5. KEVIN M. DAUGHERTY, Analog-to-Digital Conversion: A Practical Approach, McGraw-Hill International Editions, 1995.

## Teaching and learning methods

Most of the topics will be introduced, by the teacher, in presential classes. The concepts will be covered on presential sessions, were the concepts are introduced and computer-based assignments are developed. Furthermore, some additional investigation will be carried out outside the classes by means of application exercises or group work assignments.

## Assessment methods

1. Alternative 1 - (Regular, Student Worker) (Final, Supplementary, Special)
   - Development Topics - 50%
   - Final Written Exam - 50%
2. Alternative 2 - (Regular, Student Worker) (Final, Supplementary, Special)
   - Final Written Exam - 100%

## Language of instruction

Portuguese

## Electronic validation

| João Paulo Coelho | José Luís Sousa de Magalhaes Lima | Orlando Manuel de Castro Ferreira Soares | José Carlos Rufino Amaro |
|---|---|---|---|
| 01-10-2023 | 11-10-2023 | 14-10-2023 | 31-10-2023 |

This document is valid only if stamped in all pages.