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