

Course Unit	Option 3 - Data Acquisition Systems		Field of study	Electronics and Instrumentation	
Master in	Mechanical Engineering		School	School of Technology and Management	
Academic Year	2023/2024	Year of study	2	Level	2-2
Type	Semestral	Semester	1	ECTS credits	6.0
Code	5071-793-2102-02-23				
Workload (hours)	162	Contact hours	T -	TP -	PL 60
			TC -	S -	E -
			OT -	O -	

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) José Augusto de Almeida Pinheiro Carvalho, Thadeu Vinicius de Brito

#### Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:

1. understand the behaviour of data acquisition blocks and its importance in the measurement process;
2. use dedicated data acquisition hardware;
3. use virtual instrumentation software to support data acquisitions systems development;
4. develop skills in the data acquisition systems design domains.

#### Prerequisites

Before the course unit the learner is expected to be able to:

1. know the fundamentals of circuit theory;
2. use and to understand the behaviour of electronic analog and digital circuits.

#### Course contents

Elements of data acquisition system. Sample data systems theory. PC based data acquisition systems. Virtual instrumentation software LabVIEW, Matlab. Supervisory Control and Data Acquisition SCADA.

#### Course contents (extended version)

1. Data acquisition system:
  - concepts and types of acquisition systems.
2. Elements of a data acquisition system: blocks.
  - transducers;
  - signal conditioning;
  - signal conversion.
3. Sample data systems theory. Sample errors:
  - quantization errors;
  - tracking errors and aliasing errors.
  - sample rate selection.
4. PC based data acquisition systems.
  - Hardware and software for data acquisition systems.
  - Bus systems and protocols to support data acquisition.
5. Remote data and telemetry systems.
6. Software to support virtual instrumentation:
  - LabVIEW and Matlab;
  - programming and data acquisition application development.
7. Supervisory Control And Data Acquisition SCADA: concepts, architectures, and trends.

#### Recommended reading

1. H. Rosemary Taylor. Data Acquisition for Sensors Systems, Chapman & Hall, 1997. ISBN: 0-412-78560-9.
2. John G. Webster, The Measurement, Instrumentation, and Sensors Handbook, CRC Press, 1998.
3. José Augusto Carvalho, Apontamentos sobre programação e utilização do LabVIEW.

#### Teaching and learning methods

Lectures: presentation of the course contents supported on real applications examples. Problem-solving, project or laboratory: use of technological solutions on data acquisition domains. Development of a small data acquisition applications supported on virtual instrumentation software. Non-presential hours: implementation of laboratory experiments and work out the results in reports.

#### Assessment methods

- Alternative 1 - (Regular, Student Worker) (Final, Supplementary, Special)
  - Final Written Exam - 50%
  - Practical Work - 50%

#### Language of instruction

Portuguese

#### Electronic validation

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01-10-2023	11-10-2023	12-10-2023	20-10-2023