INSTITUTO POLITÉCNICO DE BRAGANÇA

Course Unit	Automation			Field of study	Automation and Control		
Bachelor in	Electrical and Computers Engineering			School	School of Technology and Management		
Academic Year	2023/2024	Year of study	1	Level	1-1	ECTS credits	6.0
Type	Semestral	Semester	2	Code	9112-742-1201-00-23		

Workload (hours)	162	Contact hours	T	TP	PL	TC	S	E	OT	O
			30	-	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): Adriano Manuel Alves Ferreira, Paulo Jorge Pinto Leitão, Ruben Alexandre Moreno Clemente

Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:
1. Apprehend the basic concepts of control in industrial automation.
2. Know the technology associated to industrial programmable devices.
3. Program logic controllers using the IEC 61131-3 languages.
4. Know the technologies associated to the sensors and actuators in industrial automation.
5. Know Human-Machine Interface (HMI) devices.
6. Design and implement industrial automation applications, based on logic controllers and involving the specification of the process.
7. Design and implement applications for the supervision and control of industrial processes, using SCADA systems.
8. Model process control applications using the Grafcet modelling language.

Prerequisites

Before the course unit the learner is expected to be able to:
1. Execute operations using Boolean algebra, binary arithmetic and numeration systems.
2. Elaborate small computational programs.

Course contents

Introduction to automation: the automation concept, application domains, supervision and control of processes. Control of processes based on logic controllers (PLC): architecture and programming using IEC 61131-3 languages. Sensors and actuators in automation. Supervision of industrial processes: supervision and control methods, HMI interfaces and SCADA. Home automation. Modeling discrete event systems using Grafcet.

Course contents (extended version)

1. Introduction to the automation
   - Concept and types of automation, application domains, supervision and control systems.
2. Programmable Logic controllers
   - Architecture, IEC 61131-3 programming languages and programming using the ladder logic language.
3. Sensors and actuators in automation
   - The need for sensors and actuators.
   - Discrete sensors: inductive, capacitive, optic, ultra-sonic, switches.
   - Special sensors: vision, barcode readers and radio frequency identifiers (RFID).
   - Actuators: motors, valves and pneumatic cylinders.
4. Supervision of industrial processes
   - Definition and objectives, supervision and control methods.
   - Human-Machine interfaces (HMI) and SCADA (Supervisory Control And Data Acquisition).
   - OPC (Open Process Control) technology.
5. Home Automation
   - Definiton, Basic concepts, architecture, interconnection and technologies.
6. Modelling discrete event systems using Grafcet
   - Symbology, basic rules, simultaneous and alternative sequences.
   - Cooperation between processes, synchronization and resource sharing.
   - Analysis of Grafcet models.

Recommended reading

1. “Automation, Production Systems and CIM”, M. P. Groover , Prentice-Hall, 1987.
2. "Fundamentals of Programmable Logic Controllers, Sensors and Communications", Jon Stenerson, Regents/Prentice Hall, 1993.
3. “Autómatos Programáveis”, António Francisco, ETEP, 2002.
4. "Programação de Autómatos, Método Grafcet", José Novais, Fundação Calouste Gulbenkian, 2ª Edição, 1994.
5. "Sensors, Principles and Applications", Peter Hauptmann, Prentice Hall, 1993.

Teaching and learning methods

Theoretical classes: exposition of the topics. Laboratorial classes: realization of exercises and laboratorial practices to support the expected learning outcomes. Learning complemented with the development of a laboratorial project, to be implemented, preferentially, during the non-presential hours.

Assessment methods

- Alternative 1 - (Regular, Student Worker) (Final, Supplementary, Special)
   - Final Written Exam - 50% (The approval requires the achievement of a minimum score of 35% in the written exam.)
   - Laboratory Work - 50% (Includes the participation in the practical classes and the development of laboratorial works.)

Language of instruction

Portuguese

Electronic validation

Adriano Manuel Alves Ferreira, Paulo Jorge Pinto Leitão, Ruben Alexandre Moreno Clemente	José Augusto de Almeida Pinheiro Carvalho	José Luís Sousa de Magalhaes Lima	José Carlos Rufino Amaro
07-03-2024	13-03-2024	13-03-2024	16-03-2024