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	2021/2022	Year of study	1	Level	1-1	ECTS credits	6.0
Type	Semestral	Semester	2	Code	9112-742-1201-00-21		

Workload (hours)	162	Contact hours	T	30	TP	-	PL	30	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)	Paulo Jorge Pinto Leitão, Henrique Jose Alves Teixeira

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 - 60%
   - Laboratory Work - 40%

Language of instruction

Portuguese, with additional English support for foreign students.

Electronic validation

Paulo Jorge Pinto Leitão	José Luís Sousa de Magalhaes Lima	Orlando Manuel de Castro Ferreira Soares	Paulo Alexandre Vara Alves
19-02-2022	02-03-2022	21-03-2022	25-03-2022