

Academic Year: ( 2023 / 2024 )

Review date: 10-04-2023

Department assigned to the subject: Systems Engineering and Automation Department

Coordinating teacher: BLANCO ROJAS, MARIA DOLORES

Type: Compulsory ECTS Credits : 6.0

Year : 2 Semester : 1

## SKILLS AND LEARNING OUTCOMES

CB1. Students have demonstrated possession and understanding of knowledge in an area of study that builds on the foundation of general secondary education, and is usually at a level that, while relying on advanced textbooks, also includes some aspects that involve knowledge from the cutting edge of their field of study.

CB2. Students are able to apply their knowledge to their work or vocation in a professional manner and possess the competences usually demonstrated through the development and defence of arguments and problem solving within their field of study.

COCIN1. Ability to draft, sign and develop projects in the area of industrial engineering for construction, renovation, repair, preservation, demolition, manufacture, installation, assembly or operation of: structures, mechanical equipment, energy installations, electrical and electronic installations, industrial plants and installations and automation and manufacturing processes.

COCIN3. Knowledge of basic and technological subject areas that will capacitate them to acquire new methods and theories and endow them with the versatility to adapt to new situations.

COCIN4. Ability to resolve problems with initiative, decision-making, creativity, and critical reasoning skills and to communicate and transmit knowledge, skills and abilities in the Industrial Engineering field.

COCIN5. Knowledge to perform measurements, calculations, assessments, appraisals, surveys, studies, reports, work plans and other similar jobs.

CEP1. Capacity to design a system, component or process in the area of electrical engineering in compliance with required specifications.

CEP2. Knowledge and ability to apply computational and experimental tools for analysis and quantification of electrical engineering problems.

CEP3. Ability to design and carry out experiments to analyze and interpret data obtained.

CER6. Knowledge of the fundamentals of automation and control methods.

ECRT8. Knowledge of the fundamentals of automatic regulation and application to industrial automation.

By the end of this content area, students will be able to have:

RA1.1. Knowledge and understanding of automation and control fundamentals.

RA2.1. The ability to apply their knowledge and understanding to identify, formulate and solve problems of industrial automation using established methods.

RA4.2. The ability to design and conduct appropriate experiments, interpret the data and draw conclusions.

RA4.3. Workshop and laboratory skills.

RA5.2. The ability to combine theory and practice to solve engineering problems of industrial automation.

## OBJECTIVES

By the end of this subject, students will be able to have:

1. Knowledge and understanding of the key aspects and concepts of automation and control methods.

2. the ability to apply their knowledge and understanding to identify, formulate and solve problems of industrial automation using established methods;

3. the ability to apply their knowledge and understanding to develop and realise designs of industrial automation systems to meet defined and specified requirements;

4. the ability to design and conduct appropriate experiments, interpret the data and draw conclusions;

5. Technical and laboratory skills.

6. the ability to select and use appropriate equipment, tools and methods;

7. the ability to combine theory and practice to solve engineering problems of industrial

## DESCRIPTION OF CONTENTS: PROGRAMME

1. Presentation and Introduction of the subject.
  - a. Definition of industrial automation concept
  - b. Historical antecedents
  - c. Continuous systems versus discrete event systems
2. Discrete events system modelling: State Diagrams and SFC. Exercise and lab classes.
  - a. Basic concepts of Booleane algebra
  - b. Sequential systems. The concept of a state.
  - c. Graphical representation of sequential systems
  - d. State Diagram Modelling. Exercise classes
  - e. Petri Nets Modelling. Basic concepts.
  - f. Functional Diagram (SFC) Modelling. Exercise classes
3. Introduction to automation technologies: wiring and programmable systems. PLC hardware.
4. PLCs programming languages:
  - a. Ladder (LD). Exercise and lab classes
  - b. Functional diagram (SFC). Exercise and lab classes
5. Actuators:
  - a. Electric engines.
  - b. Hydraulic actuators.
  - c. Pneumatic (actuators, valves, symbology)
6. Sensors:
  - a. Classification, features, etc.
  - b. Sensor description
7. Introduction to field buses.

## LEARNING ACTIVITIES AND METHODOLOGY

- Theoretical lessons and doubts solving sessions in aggregated groups, tutorial support sessions and student personal work; related to the acquisition of theoretical knowledge (2.5 ECTS).
- Laboratory and problem solving sessions in reduced groups, tutorial support sessions and student personal work; related to the acquisition of practical abilities (3.5 ECTS).

## ASSESSMENT SYSTEM

Continuous assessment consist in two exams:

- Exam 1: state and functional diagrams. PLC programming. Ladder programming.
- Exam2: a practical programming exercise will be done individually. Compulsory attendance is required to 80% of laboratory sessions and classes in Computer Classroom to take this exam.

The final exam consists in several practical exercises about modelling, programming and theoretical questions. It is required to obtain a minimum mark of 3 in this final exam in order to pass the subject.

<b>% end-of-term-examination:</b>	50
<b>% of continuous assessment (assignments, laboratory, practicals...):</b>	50

## BASIC BIBLIOGRAPHY

- Flavio Bonfatti, Paola Daniela Monari, Umberto Sampieri IEC 61131-3 Programming Methodology: Software Engineering Methods for Industrial Automated Systems, ICS Triplex, 2003
- null International Standard IEC 1131-3. , IEC, 1993
- John, Karl-Heinz, Tiegelkamp, Michael ¿ IEC 61131-3, programming industrial automation systems : concepts and programming languages, requirements for programming systems, aids to decision-making tools, Springer, 1995