Industrial Automation

Academic Year: (2023 / 2024) **Review date: 08-06-2023**

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.
CB3. Students have the ability to gather and interpret relevant data (usually within their field of study) in order to make judgements which include reflection on relevant social, scientific or ethical issues.
CB4. Students should be able to communicate information, ideas, problems and solutions to both specialist and non-specialist audiences.
CG10. Being able to work in a multi-lingual and multidisciplinary environment
CE6 Módulo CRI. Ability for the analysis, design, simulation and optimization of processes and products.
CE8 Módulo CRI. Knowledge and ability for systems modelling and simulation.
CE9 Módulo CRI. Knowledge of the fundamentals of automation and control methods and their application to industrial automation.
CT1. Ability to communicate knowledge orally as well as in writing to a specialized and non-specialized public.
CT2. Ability to establish good interpersonal communication and to work in multidisciplinary and international teams.
CT3. Ability to organize and plan work, making appropriate decisions based on available information, gathering and interpreting relevant data to make sound judgement within the study area.
CT4. Motivation and ability to commit to lifelong autonomous learning to enable graduates to adapt to any new situation.

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 automation

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 clases.
   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 clases
   e. Petri Nets Modelling. Basic concepts.
   f. Functional Diagram (SFC) Modelling. Exercise clases
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.

% end-of-term-examination:	50
% of continuous assessment (assigments, laboratory, practicals…):	50

BASIC BIBLIOGRAPHY

- Antonio Barrientos Cruz; Jaime del Cerro Giner Diseño de automatismos con grafcet. Teoría y ejemplos, Garceta, 2022
- 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