

Course guide 340120 - AUIN-K5007 - Industrial Automation

Last modified: 18/06/2024

Unit in charge: Teaching unit:	Vilanova i la Geltrú School of Engineering 707 - ESAII - Department of Automatic Control.
Degree:	BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Optional subject). BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus
	2009). (Compulsory subject).
	BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Optional subject).
	BACHELOR'S DEGREE IN INFORMATICS ENGINEERING (Syllabus 2018). (Optional subject).
Academic year: 2024	ECTS Credits: 6.0 Languages: Catalan, Spanish

LECTURER	
Coordinating lecturer:	CRISTOBAL RAYA GINER
Others:	De Sousa Perez, Oscar

PRIOR SKILLS

Generic knowledge of electronic instrumentation, industrial computer science and control is recommended

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

- 4. CE28. Applied knowledge of industrial and communication computing.
- 1. CE12. Knowledge of fundamental automatism and control methods.
- 2. CE15. Basic knowledge of production and fabrication systems.
- 3. CE29. Ability to design automotion control systems.

Transversal:

5. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

6. SELF-DIRECTED LEARNING - Level 2: Completing set tasks based on the guidelines set by lecturers. Devoting the time needed to complete each task, including personal contributions and expanding on the recommended information sources.

7. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 1. Planning oral communication, answering questions properly and writing straightforward texts that are spelt correctly and are grammatically coherent.

8. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.

9. EFFECTIVE USE OF INFORMATION RESOURCES - Level 1. Identifying information needs. Using collections, premises and services that are available for designing and executing simple searches that are suited to the topic.

10. EFFECTIVE USE OF INFORMATION RESOURCES - Level 2. Designing and executing a good strategy for advanced searches using specialized information resources, once the various parts of an academic document have been identified and bibliographical references provided. Choosing suitable information based on its relevance and quality.



TEACHING METHODOLOGY

In the learning sessions of this subject, the professor will introduce theoretical explanations and illustrative examples, concepts, methods and basic results of the matter. These sessions are made of theoretical classes and sessions of laboratory. Along the course the method of project/problems based learning (PBL) will be applied.

In the theoretical classes the theoretic explanations and the basic concepts of the subject of study will be introduced, and in the practical sessions of laboratory the professor will increase the knowledge with the concepts and necessary methods to be able to carry out the problems or projects to solve in the practical work. The practices of laboratory will come true individually, or in reduced groups.

The tasks outside of the classroom that one must carry out or individually or in group, they are the base of the activities, and obligatory to be able to progress appropriately in the subject. These activities include the problems and proposed works, and the previous works to be able to carry out the practices.

LEARNING OBJECTIVES OF THE SUBJECT

Presenting the general characteristics of the automatic systems of production

Capacity of developing projects of automation and supervised control.

Recognizing the nature from the input-output signals to the system and choosing the appropriate interfaces for his use.

Analyzing a problem, specifying elements hardware adequate and designing an algorithm that resolves it with his temporary restrictions.

To program in a programming language he structures it corresponding to an algorithm of efficient way.

Evaluating the reliability of a solution of an automatic system and control, and if necessary identifying errors and accomplishing the necessary modifications in order that related solution obtain the expected results.

STUDY LOAD

Туре	Hours	Percentage
Hours large group	15,0	10.00
Hours small group	45,0	30.00
Self study	90,0	60.00

Total learning time: 150 h

CONTENTS

T1 Introduction

Description:

Automated manufacturing systems. Manufacturing processes. CIM Concept.

Specific objectives:

Knowing and learning the characteristics of the systems and processes of automation of production.

Related activities:

Evaluation in the exam.



T2 Sensors and industrial actuators

Description:

Types and characteristics of the industrial sensors. Types and characteristics of the industrial actuators. Pneumatics.

Specific objectives:

Knowing and learning types and the characteristics of the sensors and basic actuators used in automation. Knowing and learning basic concepts of pneumatic circuits.

Related activities:

Evaluation in the exam. Realization of works and or problems.

T3 Programmable logic controllers

Description:

Architecture of PLCs and computer peripherals. Programming languages of PLCs according to standard IEC 1131-3. GRAFCET. Gemma guides. Security systems.

Specific objectives:

To know and to learn the operation of the programmable logic controllers, as well as their programming tools.

Related activities:

Evaluation in the exam. Realization of works and/or problems. The learning will be supplemented by means of laboratory activities in that they were carried out practical applications with PLCs.

T4 Supervision of industrial processes

Description:

SCADA systems. Industrial communications networks. Design of supervisory interfaces and HMI. Monitoring of processes.

Specific objectives:

Knowing the industrial systems of supervision based principally in SCADA. To know different kinds of industrial communications networks used to transfer information between PLCs and SCADAs (Profibus, Devicenet, OPC, etc).

Related activities:

Evaluation in the exam. Realización de trabajos y/o problemas. Realization of works and/or problems. The learning will be supplemented by means of laboratory activities.

T5 Home Automation

Description:

Adapted automation to the houses. Characteristics of the home automation systems. Architecture and technology of the home automation standards. Integration with other systems. Applications.

Specific objectives:

To know the standard home automation systems (X-10, EIB, etc...), their integration with other systems like teams multimedia, internet, etc. To Know examples of applications.

Related activities:

Evaluation in the exam. Realization of works and/or problems.



PR Practices in laboratory

Description:

Different practices and projects based on the programming of logical programmable (PLCs) controllers and programmable relays will develop, and the monitoring of PLCs with SCADA and HMI.

Specific objectives:

Learning concepts of operation of PLCs (types, languages, timers, counters, interrupts, etc.). To learn how to solve automation problems with the appropriate tools. To learn how to dominate the use of GRAFCET like tool of representation of automated processes and their mediating implementation the programming in different languages according to the norm IEC 1131 -3. . Learn the design of monitoring systems associated to automated systems.

Related activities:

Realization of the activities of laboratory in a present way.

GRADING SYSTEM

This evaluation is formed by one or two exams of evaluation PA, practical works (including exam) PR, and works or problems in a group or individual TGI.

The weighted average of the final note NF corresponds to

NF = 0,45xPA + 0,45xPR + 0,1xTGI.

The reassessment exam score only replaces the PA assessment tests.

EXAMINATION RULES.

The evaluation tests will be carried out individually.

It is indispensable condition to have carried out the practices with sufficiency and in a present way to be evaluated. For the realization of the practices one must have carried out the previous necessary studies correctly A follow-up of the progress of the works will be carried on and its presentation.

BIBLIOGRAPHY

Basic:

Boix Aragonès, Oriol; Sudrià Andreu, Antoni; Bergas Jané, Joan. Automatització industrial amb GRAFCET [on line]. Barcelona: Edicions UPC, 2001 [Consultation: 01/03/2022]. Available on: <u>https://upcommons.upc.edu/handle/2099.3/36537</u>. ISBN 8483014998.
Ponsa Asensio, Pere. Automatización de procesos mediante la guía GEMMA [on line]. Barcelona: Edicions UPC, 2005 [Consultation: 23/02/2024]. Available on: <u>https://upcommons.upc.edu/handle/2099.3/36684</u>. ISBN 848301811X.

- Mandado Pérez, Enrique [et al.]. Autómatas programables : entorno y aplicaciones. Madrid: International Thomson Paraninfo, 2011. ISBN 8497323289.

- Hanssen, Dag H. Programmable logic controllers : a practical approach to IEC 61131-3 using CODESYS [on line]. Chichester West Sussex, United Kingdom: Wiley, 2015 [Consultation: 12/02/2024]. Available on: https://onlinelibrary-wiley-com.recursos.biblioteca.upc.edu/doi/book/10.1002/9781118949214. ISBN 9781118949214.

- Mandado Pérez, Enrique. Sistemas de automatización y autómatas programables. 3a ed. Barcelona: Marcombo, 2018. ISBN 9788426725899.

Complementary:

Rodríguez Penin, Aquilino. Sistemas SCADA [on line]. 3a ed. Barcelona: Marcombo, 2012 [Consultation: 28/04/2022]. Available on: https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=3175459. ISBN 9788426717818.
Junestrad, Stefan [et al.]. Domótica y hogar digital. Madrid: Thomson Paraninfo, 2005. ISBN 8428328919.



RESOURCES

Hyperlink:

- http://www.infoplc.net. Actualitat i recursos d'automatització industrial

- <u>http://industrial.omron.es</u>. Informació del fabricant de components d'automatizació industrial OMRON, amb documentació i altres informacions.