DEGREE CURRICULUM

INDUSTRIAL AUTOMATION

Coordination: GUIRADO FERNANDEZ, FERNANDO

Academic year 2023-24

INDUSTRIAL AUTOMATION 2023-24

Subject's general information

<table>
<tr><td>Subject name</td><td>INDUSTRIAL AUTOMATION</td></tr>
<tr><td>Code</td><td>102115</td></tr>
<tr><td>Semester</td><td>2nd Q(SEMESTER) CONTINUED EVALUATION</td></tr>
<tr><td>Typology</td><td>
<table>
<tr><th>Degree</th><th>Course</th><th>Character</th><th>Modality</th></tr>
<tr><td>Bachelor's Degree in Automation and Industrial Electronic Engineering</td><td>2</td><td>COMPULSORY</td><td>Attendance-based</td></tr>
<tr><td>Bachelor's Degree in Energy and Sustainability Engineering</td><td>2</td><td>COMPULSORY</td><td>Attendance-based</td></tr>
<tr><td>Bachelor's Degree in Mechanical Engineering</td><td>2</td><td>COMPULSORY</td><td>Attendance-based</td></tr>
<tr><td>Common branch in industrial engineering programs - Lleida</td><td>2</td><td>COMPULSORY</td><td>Attendance-based</td></tr>
<tr><td>Double bachelor's degree: Degree in Mechanical Engineering and Degree in Energy and Sustainability Engineering</td><td>2</td><td>COMPULSORY</td><td>Attendance-based</td></tr>
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<tr><td>Course number of credits (ECTS)</td><td>6</td></tr>
<tr><td>Type of activity, credits, and groups</td><td>
<table>
<tr><th>Activity type</th><td>PRALAB</td><td>TEORIA</td></tr>
<tr><th>Number of credits</th><td>3</td><td>3</td></tr>
<tr><th>Number of groups</th><td>4</td><td>3</td></tr>
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<tr><td>Coordination</td><td>GUIRADO FERNANDEZ, FERNANDO</td></tr>
<tr><td>Department</td><td>COMPUTER ENGINEERING AND DIGITAL DESIGN</td></tr>
<tr><td>Teaching load distribution between lectures and independent student work</td><td>40% lectures
60% autonomous work</td></tr>
<tr><td>Important information on data processing</td><td>Consult this link for more information.</td></tr>
<tr><td>Language</td><td>Catalan, Spanish and English</td></tr>
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Distribution of credits	20% theoretical content 30% classroom activities 50% laboratory

INDUSTRIAL AUTOMATION 2023-24

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
GUIRADO FERNANDEZ, FERNANDO	fernando.guirado@udl.cat	6	
MATEO FORNÉS, ADRIÀ	adria.mateo@udl.cat	6	
PELLISÉ PALACIOS, MARC ALBERT	mpellis9@xtec.cat	9	

Subject's extra information

Most practical course in which the study is based on problem solving and recommended mandatory. It is essential for personal work skills set and gain the skills to properly use the tools that work with the course.

Materials can be found on the Virtual Campus: http://cv.udl.cat

The use of Virtual Campus access to resources is fundamental to the subject, the notifications delivery dates workout, schedule meetings and finally delivering practical assessment tests.

Learning objectives

- Acquire knowledge about the fundamentals of automation and methods of control.
- Determine the transfer function of dynamic electrical systems.
- Explain the concept of an open loop control system and closed loop and identify the elements that make up them.
- Understand the meaning of the concepts of Control System and Industrial Process, understanding its relation.
- Know how to design simple wiring automation.
- Understand the internal architecture of a PLC and the its cycle of operation.
- Know the components of the GRAFCET diagrams.
- Know how to design a GRAFCET that implements a sequential industrial process.
- Know how to program and debug a PLC program.

Competences

Specific competences

GEM12/GEEIA12/CG12. Knowledge of the basics of automatisms and control methods.

CE10. Have knowledge of the principles of automatic regulation and its application to industrial automation.

CE14. Acquire the ability to design industrial automation and control systems.

Cross-disciplinary competences

EPS1/CB2. Capacity to solve problems and prepare and defence arguments inside the area of studies.

EPS7. Capacity to work in situations with a lack of information and/or under pressure.

Subject contents

1. Automatic regulation.
    - 1.1 Introduction to automatic regulation
    - 1.2 Dynamic systems
    - 1.3 Feedback control systems
    - 1.4 Regulators
    - 1.5 Control structures
    - 1.6 Classification of the industrial processes
2. Wired automations.
    - 2.1 Introduction
    - 2.2 Power and maneuvering devices
    - 2.3 Power circuit and maneuver
3. Sensors and actuators
    - 3.1 Transducers - Classification
    - 3.2 Signal transmission
    - 3.3 Dynamic and static characteristics
    - 3.4 Types of sensors
4. Scheduled automations.
    - 4.1 Introduction
    - 4.2 Control systems
    - 4.3 Programmable Logic Controller (PLC)
    - 4.4 Human-Machine Interfaces (HMI)
    - 4.4 PLC programming
5. Sequential processes: GRAFCET
    - 5.1 Introduction
    - 5.2 Components
    - 5.3 Structures
    - 5.4 Rules of evolution
    - 5.5 Special control structures

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Methodology

This subject combines theoretical and problem sessions as well as practical exercises and laboratory work.

Most of the practical activities will be developed individually although the projects must be carried out in work teams made up of 2 students.

Methodology used:

- Master classes where the basic concepts of the contents will be explained.
- Classes of problems where exercises related to the master classes will be developed.
- Laboratory practices developing and expanding concepts of the different topics.
- All activities involve student autonomous work

The follow-up of the subject will be done through the delivery of exercises worked in the class sessions or independently through the Virtual Campus. Questionnaires will also be carried out in online format.

In addition, students will have the responsibility to reinforce their knowledge in a way autonomous based on the teaching material provided or recommended by the teacher.

Development plan

Week	Content	Scheduling
1	1. Lecture class and exercices.	2h online / 2h Lecture class / 6h Autonomous work
2	2. Lecture class and exercices.	2h online / 2h Lecture class / 6h Autonomous work
3	2. Exercices.	2h online / 2h Lecture class / 6h Autonomous work
4	2. Exercices.	2h online / 2h Lecture class / 6h Autonomous work
5	3. Lecture class and exercices.	2h online / 2h Lecture class / 6h Autonomous work
6	3. Practices	2h online / 2h Lecture class / 6h Autonomous work
7	3. Practices	2h online / 2h Lecture class / 6h Autonomous work
8	3. Practices	2h online / 2h Lecture class / 6h Autonomous work
9	Midterm-evaluation	
10	4. Lecture class and exercices.	2h online / 2h Lecture class / 6h Autonomous work
11	4. Practices	2h online / 2h Lecture class / 6h Autonomous work
12	4. Practices	2h online / 2h Lecture class / 6h Autonomous work
13	5. Lecture class and exercices.	2h online / 2h Lecture class / 6h Autonomous work
14	5. Practices	2h online / 2h Lecture class / 6h Autonomous work
15	5. Practices	2h online / 2h Lecture class / 6h Autonomous work

Evaluation

Evaluation

Block	Id	Activity	Weights	Mín. Grade	Group	Compulsory	Recovery
	T1	*Test Topic 1*	2%	No	No	No	Yes

Theory	*T2*	*Test Topic 2*	2%	No	No	No	Yes
	T3	*Test Topic 3*	2%	No	No	No	Yes
	T4	*Test Topic 4*	2%	No	No	No	Yes
	T5	*Test Topic 5*	2%	No	No	No	Yes
	P1	*1r mid-term*	15%	No	No	Yes	Yes
	P2	*2n mir-term*	15%	No	No	Yes	Yes
*LAB1**	*PR1*	*Laboratory 1*	10%	No	No	Yes	No
*LAB2**	*PR2*	*Laboratory 2*	10%	No	No	Yes	No
*LAB3**	*PR3*	*Laboratory 3*	10%	No	No	Yes	No
PRJ1	*PRJ1*	*Project 1*	15%	No	Yes – 2	Yes	No
PRJ2	*PRJ2*	*Project 2*	15%	No	Yes – 2	Yes	No
The recovery activity will correspond to a single exam that will include the Theory Block and will correspond to 40% of the mark.							

(*) Attendance at the laboratory is compulsory at the assigned group

Alternative Evaluation

Block	Id	Activity	Weights	Mín. Grade	Group	Compulsory	Recovery
Theory	*EXAM*	*Final Exam*	50%	No	No	Sí	Sí
PRJ1	*PRJ1*	*Project1*	25%	No	No	Sí	No
PRJ2	*PRJ2*	*Project 2*	25%	No	No	Sí	No
The recovery activity will correspond to a single exam that will include the Theory Block and will correspond to 50% of the mark.							

Bibliography

[1] Autómatas Programables. Joseph Balcells, J. L. Romeral, Ed. Marcombo – Serie Mundo Electrònico, ISBN 84-267-1089-1

[2] Automatización. Problemas Resueltos con Autómatas Programables. L. Pedro Romera, J. Antonio Lorite, Sebastián Montoso, Editorial Paraninfo, ISBN 84-283-2077-2

[3] Automatización con GRAFCET, Múltiples autores, Servicio de publicaciones – Universidad de Málaga, ISBN – 84-7496-724-4

[4] Dorf, Richard C. Sistemas modernos de control. 2ª ed. en esp.. Argentina, [etc.]: Addison-Wesley Iberoamericana, 1989. ISBN 0201644177 (ADDISON WESLEY)

[5] Ogata, Katsuhiko. Ingeniería de control moderna. 5a ed.. Madrid [etc.]: Pearson Educación, cop. 2010. ISBN 9788483226605.

[6] Groover, Mikell P. Automation, production systems and computer-integrated manufacturing. 3rd ed.. Upper Saddle River, NJ: Prentice Hall, c2008. ISBN 9780132070737.