DEGREE CURRICULUM

INDUSTRIAL AUTOMATIZATION

Coordination: BAQUERO ARMANS, GRAU

Academic year 2021-22

INDUSTRIAL AUTOMATIZATION 2021-22

Subject's general information

<table>
<tr><td>Subject name</td><td>INDUSTRIAL AUTOMATIZATION</td></tr>
<tr><td>Code</td><td>102335</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 Industrial Organization and Logistics Engineering</td><td>2</td><td>COMPULSORY</td><td>Attendance-based</td></tr>
<tr><td>Not informed</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><th>PRALAB</th><th>PRAULA</th><th>TEORIA</th></tr>
<tr><td>Number of credits</td><td>1</td><td>2</td><td>3</td></tr>
<tr><td>Number of groups</td><td>3</td><td>2</td><td>1</td></tr>
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<tr><td>Coordination</td><td>BAQUERO ARMANS, GRAU</td></tr>
<tr><td>Department</td><td>COMPUTER SCIENCE AND INDUSTRIAL ENGINEERING</td></tr>
<tr><td>Teaching load distribution between lectures and independent student work</td><td>Lectures: 40%
Independent work: 60%</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
Some resources in Spanish and English</td></tr>
<tr><td>Distribution of credits</td><td>Theoretical credits: 3 ECTS
Room practices credits: 2 ECTS
Lab practices credits: 1 ECTS</td></tr>
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INDUSTRIAL AUTOMATIZATION 2021-22

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
BAQUERO ARMANS, GRAU	grau.baquero@udl.cat	7,5	
PARE BUSTO, MARC	marc.pare@udl.cat	2,5	

Subject's extra information

You can find educational materials on the Virtual Campus: http://cv.udl.cat

The use of the Virtual Campus is fundamental to access resources of the subject, exercises deadline notifications, practices delivery and evaluation tests.

It is **COMPULSORY** that the students bring the following elements of individual protection (EPI) to the practices at the laboratory.

- Laboratory gown from UdL
- Protection glasses
- Mechanical protection gloves

They can be purchased through the shop Údels of the UdL:

C/ Jaume II, 67 baixos
Centre the Cultures i Cooperació Transfronterera

http://www.publicacions.udl.cat/

There will be a specific service for the *Campus Universitari d'Igualada*.

The use of other elements of protection (for example caps, masks, gloves of chemical or electrical risk, etc.) will depend on the type of practice to be done. In that case, the teacher will inform of the necessity of specific EPI.

Not bringing the EPI's described or not fulfilling the norms of general security that are detailed below imply that the student can not access to the laboratories or have to go out of them. The no realisation of the practices for this reason imply the **consequences in the evaluation** of the subject that are described in this course guide.

GENERAL NORMS OF SECURITY IN LABORATORY PRACTICES

- Keep the place of realisation of the practices clean and tidy. The table of work has to be free from backpacks, folders, coats...
- No short trousers or short skirts are allowed in the laboratory.
- Closed and covered footwear is compulsory in the laboratory.
- Long hair needs to be tied.
- Keep the laboratoy gown laced in order to be protected from spills of chemicals.

- Bangles, pendants or wide sleeves are not allowed as they can be trapped.
- Avoid the use of contact lenses, since the effect of the chemical products is much bigger if they enter between the contact lense and the cornea. Protection over-glasses can be purchased.
- No food or drink is allowed in the laboratory.
- It is forbidden to smoke in the laboratories.
- Wash your hands whenever you have contact with a chemical product and before going out of the laboratory.
- Follow the instructions of the teacher and of the laboratory technicians and ask for any doubt on security.

For further information, you can check the following document of the *Servei de Prevenció de Riscos Laborals de la UdL*: http://www.sprl.udl.cat/alumnes/index.html

Learning objectives

- Acquiring knowledge on the basics of automation and control methods.
- Determining the transfer function of dynamic electrical, mechanical and chemical systems.
- Calculating the temporal response of dynamic systems according to the type of excitation and the initial conditions.
- Explaining the concept of an open loop and closed loop control system and identifying their elements.
- Understanding the meaning of control system and industrial process concepts, understanding their relationship.
- Knowing the existing technologies when creating an industrial process.
- Identifying and explains the operation of the most common sensors.
- Knowing the different types of automation and its integration in control systems.
- Being able design simple wired automations.
- Knowing the internal architecture of a programmable automation.
- Knowing the operating cycle of a PLC.
- Being able to distinguish the input and output components in the programmable controllers and their use.
- Knowing the GRAFCET diagrams elements and their relationships.
- Knowing the different programming languages of programmable controllers.
- Being able to program and debug a programmable controller.

Competences

Basic Competences

B01 That students have demonstrated to possess and understand knowledge in an area of study that starts from the base of general secondary education, and is usually found at a level that, although supported by advanced textbooks, also includes some aspects that imply knowledge coming from the vanguard of his/her field of study.

B02 That students know how to apply their knowledge to their work or vocation in a professional manner and possess the skills that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study.

B03 That students have the ability to gather and interpret relevant data (usually within their area of study) to make judgments that include a reflection on relevant social, scientific or ethical issues.

B04 That students can transmit information, ideas, problems and solutions to a specialized and non-specialized public.

B05 That students have developed those learning skills necessary to undertake further studies with a high degree of autonomy.

General competences

CG1. To conceptualize the drafting, signing and development of projects in the field of engineering in industrial organization, which have as their object, according to the specific technology training, the construction, reform,

repair, conservation, demolition, manufacture, installation, assembly or exploitation of: structures, mechanical equipment, energy facilities, electrical and electronic installations, industrial facilities and processes and manufacturing and automation processes.

CG3. To synthesize basic and technological subjects, which enable them to learn new methods and theories, and provide them with versatility to adapt to new situations.

CG4. To Solve problems with initiative, make decisions, creativity, critical reasoning and to communicate and transmit knowledge, skills and abilities in the field of Industrial Chemical/Organization Engineering.

CG5. To carry out measurements, calculations, valuations, appraisals, surveys, studies, reports, work plans and other analogous work.

CG6. To implement specifications, regulations and mandatory rules.

CG10. To work in a multilingual and multidisciplinary environment.

CG11. Understand and apply the necessary legislation in the exercise of the profession of Industrial Technical Engineer.

Specific competences

CE12. To acquire knowledge about the basics of automation and control methods.

Transversal Competences

CT2. To develop meaningful command of a foreign language, especially English.

CT3. To implement new technologies and technologies of information and communication.

CT4. To apply basic knowledge of entrepreneurship and professional environments.

CT5. To apply essential notions of scientific thinking.

Subject contents

- Topic 1: Introduction to automation control systems
- Topic 2: Wired automation
- Topic 3: Programmable Automation
- Topic 4: Sequential processes: GRAFCET

Methodology

This subject combines theoretical sessions and problems, practical exercises and work in the laboratory with specific software and machines.

Most practical activities will be developed in reduced work teams. If possible, external visits and / or seminars will also be made.

The methodology used in the topics envisaged is:

- Master classes where the basic concepts of the contents will be explained.
- Classes of problems where exercises related to master classes will be developed.
- Laboratory practices focused on topics 1, 2 and 6 (concepts will appear on the other topics)
- Joint project:
    - The project taught in the first year 2nd semester integrates the following courses: Fluid Mechanics, Industrial Automation and Electronic Engineering Basics.
    - The project coordinator will monitor the tasks to be submitted, as outlined in the timeline provided at

the beginning of the course.
- All the subjects involved in the project will be registered jointly. In the circumstance that the students might have passed more than 50% of the subjects involved in the project, they will be allowed to write an equivalent project focused on the subject they are currently taking.

The follow-up of the subject will be done by means of the delivery of exercises through the Virtual Campus and the realization of questionnaires.

In order to develop the theoretical classes in virtual format, the following will be taken into account:

- Theoretical classes using the virtual campus videoconferencing tool with its recording in case of explanations of theory, problems or presentation of practical lessons (not all doubt sessions will be recorded due to their variety of content).
- Use of the test / query / ... tools to develop the following-up of more theoretical parts.
- Use of individual exercise deliveries and also through forums to facilitate interaction between students.

Development plan

Week	Methodology	Content	Class hours	Independent work hours
1	Master class Exercises	Topic 1	4	4
2	Master class Exercises	Topic 1	4	4
3	Master class Exercises	Topic 2	4	4
4	Master class Exercises Practice	Topic 2 Practice 1	4	6
5	Master class Exercises	Topic 2 Project (1h)	4	6
6	Master class Exercises	Topic 2 Topic 3	4	6
7	Master class Exercises	Topic 3	4	6
8	Master class Exercises Practice	Topic 3 Practice 2	4	6
9	Evaluation	Exam 1	2	6
Easter				
10	Master class Exercises	Topic 3 Project (2h)	2	6
11	Master class Exercises Practice	Topic 3 Practice 3	4	6
12	Master class Exercises	Topic 3 Topic 4	4	6

13	Master class Exercises Practice	Topic 4 Practice 4	4	6
14	Master class Exercises Practice	Topic 4 Practice 5	4	6
15	Master class Exercises	Topic 4	2	6
16-17	Evaluation	Exam 2	2	6
18	Tutoring	Tutoring		
19	Evaluation	Retake	4	

The joint project will be developed during the course.

Evaluation

The final grade of the subject will be the sum of the following percentages:

- Exams
  - Test 1: 30%
  - Test 2: 30%
- Exercises: 10%
- Practices: 10%
- Joint project: 20%

Test 1 and Test 2 activities each require a minimum of 3.5 out of 10 to weigh in the final grade.

Retake activity allows re-evaluating the percentage corresponding to *Exams* (*Test 1* and *Test 2*, 60%).

Bibliography

- Autómatas Programables. **Joseph Balcells, Jose Luis Romeral**, Ed. Marcombo – Serie Mundo Electrònico, ISBN 84-267-1089-1
- Automatización. Problemas Resueltos con Autómatas Programables. **Juan Pedro Romera, Juan Antonio Lorite, Sebastián Montoso**, Editorial Paraninfo, ISBN 84-283-2077-2
- Automatización con GRAFCET, **Múltiples autores**, Servicio de publicaciones – Universidad de Málaga, ISBN – 84-7496-724-4
- Sistemas modernos de control. 2ª ed. en esp. **Richard C. Dorf.** Argentina, [etc.]: Addison-Wesley Iberoamericana, 1989. ISBN 0201644177 (ADDISON WESLEY).
- Ingeniería de control moderna. 5a ed. **Katsuhiko Ogata**. Madrid [etc.]: Pearson Educación, cop. 2010. ISBN 9788483226605.
- Automation, production systems and computer-integrated manufacturing. 3rd ed. **Mikell P. Groover**. Upper Saddle River, NJ: Prentice Hall, c2008. ISBN 9780132070737.