Universitat de Lleida

DEGREE CURRICULUM

INDUSTRIAL INSTRUMENTATION

Coordination: COLELL PONS, FRANCESC

Academic year 2022-23

INDUSTRIAL INSTRUMENTATION 2022-23

Subject's general information

<table>
<tr><td>Subject name</td><td>INDUSTRIAL INSTRUMENTATION</td></tr>
<tr><td>Code</td><td>102126</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>3</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><th>Number of credits</th><td>0.4</td><td>2.6</td><td>3</td></tr>
<tr><th>Number of groups</th><td>1</td><td>1</td><td>1</td></tr>
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</td></tr>
<tr><td>Coordination</td><td>COLELL PONS, FRANCESC</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>5 % classroom
35 % not in person
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>Language Percentage of use
Catalan 50 %
Spanish 30 %
English 20 %</td></tr>
<tr><td>Distribution of credits</td><td>66 % theoretical content
17 % classroom activities
17 % laboratory practices</td></tr>
</table>

INDUSTRIAL INSTRUMENTATION 2022-23

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
COLELL PONS, FRANCESC	francesc.colell@udl.cat	5,6	
PALACIN ROCA, JORGE	jordi.palacin@udl.cat	,4	

Subject's extra information

This course is intended for students to acquire skills in the analysis and study of industrial instrumentation associated with industrial processes, its regulations and its applications. In fact, in all industrial activity there is a need to measure, control and monitor the operation of the processes, therefore there is a need for specialized personnel in industrial instrumentation.

In order to successfully pass the evaluations, the attendance and active participation of the student to the face-to-face classes is recommended.

They have to have knowledge of analysis and development of electronic circuits, analogy and digital. For this reason it is recommended to have completed the second year subjects: fundamentals of electronic engineering, industrial automation and fundamentals of electrical engineering.

You can find teaching materials to the Virtual Campus: http://cv.udl.cat

The use of the Virtual Campus is essential to access the resources of the subject, notifications on the delivery data of exercises, schedule of sessions and finally the delivery of practices and evaluation tests.

Learning objectives

It is intended that the student:

- Acquire skills in the analysis and study of industrial instrumentation associated with industrial processes, current regulations and their applications.
- Have the ability to analyze and decide which type of sensor is the most convenient when you want to measure, control and / or monitor the operation of industrial processes.

Competences

Degree-transversal competences

- **EPS1.** Ability to solve problems and develop and defend arguments in their area of study.
- **EPS2.** Capacity to gather and interpret relevant data, within the area of study, to judge and think about relevant subjects of social, scientific and ethical nature.

Degree-specific competences

- **GEEIA25**. Knowledge and capacity for modelling and simulation of systems.
- **GEEIA26**. Knowledge of automation and technical regulation of control and his application to the industrial automation.
- **GEEIA27**. Knowledge of principles and applications of robotic systems.
- **GEEIA29**. Capacity to design systems of industrial automation control.

Subject contents

Industrial instrumentation regulations:

- ISA S5.1, codes and symbology.
- ISA S5.2, binary logic diagrams.
- ISA S5.3, graphic symbols for control.
- ISA S5.4, instrument loop diagrams.
- ISA S5.5, graphic symbols for monitoring.
- SAMA Symbology.

Flow diagrams and instrumentation drawings.

Standard EN 60617. Low Voltage Electro Technical Regulations (REBT).

Basics for measuring instruments.

Different sensors and gauges of physical parameters:

- Potentiometric sensors.
- Strain gauges.
- Metal resistance temperature (RTD) sensors.
- Thermistors.
- Photoresistors and other resistive sensors.
- Capacitive.
- Inductive.
- Electromagnetic.
- Hall effect sensors.
- Thermocouples, piezoelectric and pyroelectric.
- Optoelectronics.
- Ultrasound sensors.
- Fiber optic sensors.
- Biosensors.
- Microsensors.

Examples of applications with detectors.

Criteria for the selection of sensors.

Methodology

The face-to-face activities:

- **Laboratory practices**: electronic circuits are mounted with real detectors to check the behavior of industrial instrumentation.

The face-to-face activities are divided into three parts that complement each other:

- **Master Classes**: in theoretical classes, the most relevant theoretical concepts and results are introduced, illustrating them with examples and exercises.
- **Problems**: exercises of gradual difficulty are solved to consolidate the concepts and notions developed in the theory classes.

The remote tasks will be:

- **Images of the teacher's notes:** in the Resources section of the Virtual Campus images of the teacher's notes will be uploaded, which contain annotations and highlighted texts in comparison to the student's notes.
- **Videoconferences:** with the purpose of describing the notes, resolving doubts and answering questions.
- **Remote activities:** some activities will be added in the Virtual Campus in order to evaluate the 10% instead of the laboratory practices that won't be carried out.

Development plan

Order	Content	Dedication (hours)
1	Presentation + Introduction + Standard UNE + Industrial instrumentation project document.	2 class 3 autonomous work
2	Identification regulations (S5.5 + S5.1) + Exercises	1 class + 1 exercises 3 autonomous work
3	Identification regulations (S5.1 + S5.3) + Exercises.	1 class + 1 exercises 3 autonomous work
4	Loop diagrams (S5.4) + Exercises.	1 class + 1 exercises 3 autonomous work
5	Logical diagrams regulation (S5.2) + Exercises.	1 class + 1 exercises 3 autonomous work
6	Pipe and instrumentation diagram (P&ID) + Exercises.	1 class + 1 exercises 3 autonomous work
7	SAMA Symbology + Exercises.	1 class + 1 exercises 3 autonomous work
8	Standard EN 60617. Low Voltage Electro Technical Regulations (REBT) + Exercises.	1 class + 1 exercises 3 autonomous work
9	Basic fundamentals of the sensors + Potentiometric sensors.	2 class 3 autonomous work
10	Strain gauges + Exercises.	2 class + 2 practices 6 autonomous work
11	Photoresistors + Other resistive sensors.	2 class 3 autonomous work
12	Metal resistance temperature sensors (RTD) + Thermistors.	2 class 3 autonomous work
13	Practice of Photoresistance	2 practices
14	Thermocouples + Exercises.	1 class + 1 exercises 3 autonomous work
15	Practice of RTD.	2 practices
16	Piezoelectric sensors + Ultrasound sensors + Exercises.	1 class + 1 exercises 3 autonomous work
17	Practice of Thermistors.	2 practices
18	Capacitive sensors + Inductive sensors.	2 class 3 autonomous work
19	Practice of Inductive sensor.	2 practices

20	Electromagnetic sensors + Exercises.	1 class + 1 exercises 3 autonomous work
21	Hall effect sensors + Exercises.	1 class + 1 exercises 3 autonomous work
22	Pyroelectric sensors + Exercises.	1 class + 1 exercises 3 autonomous work
23	Optoelectronic sensors + Exercises.	1 class + 1 exercises 3 autonomous work
24	Fiber sensors + Exercises.	1 class + 1 exercises 3 autonomous work
25	Biosensors + Exercises.	1 class + 1 exercises 3 autonomous work
26	Microsensors + Exercises.	1 class + 1 exercises 3 autonomous work
27	Criteria for the selection of sensors + Exercises.	1 class + 1 exercises 3 autonomous work

Evaluation

The total score is broken down as follows:

- 9th week, partial: PA1 theoretical exam that will score 40% = 15% test + 25% exercises.
- 16th week, exams: PA2, theoretical exam that will score 40% = 15% test + 25% exercises.
- 16th week: Work done that will score 20% = 10% practices + 10% class activities.

  NOTE: in order to apply the score of the work done, it is necessary that the student has obtained a score equal to or greater than 40% by adding PA1 + PA2.

- 19th week, recovery activities: theoretical recovery exam that will score 100% = 50% test + 50% exercises.

Bibliography

COURSE NOTES.

RULES:

- "Instrumentation Symbols and Identification", ANSI/ISA-S5.1, 1984 (R1986).
- "Binary Logic Diagrams for Process Operations", ANSI/ISA-S5.2, 1976 (R1981).
- "Graphic Symbols for Distributed Control/Shared Display Instrumentation, Logic, and Computer Systems", ANSI/ISA-S5.3, 1983.
- "Instrument Loop Diagrams", ANSI/ISA-S5.4, 1976 (R1991).
- "Graphic Symbols for Process Displays", ANSI/ISA-S5.5, 1985 (R1986).
- "SIMBOLOGIA SAMA", ING. QUIRINO JIMENEZ DOMINGUEZ.
- "REBT – REGLAMENTO ELECTROTECNICO DE BAJA TENSION", AENOR.

BOOKS:

ISBN: 978-9942-8603-7-8.

Title: FUNDAMENTOS BASICOS DE INSTRUMENTACION Y CONTROL (1ª edición, 2017).

Authors: Marllelis del Valle Gutiérrez Hinestroza; Sadi Armando Iturralde Kure.

Editorial: UPSE.

ISBN(13): 9788497321662

Title: INSTRUMENTACIÓN ELECTRÓNICA (1ª)

Authors: Grillo Ortega, Gustavo Jacinto; Ferrero Martín, Francisco Javier;

Campo Rodríguez, Juan Carlos; Álvarez Antón, Juan Carlos; Pérez García, Miguel Ángel.

Editorial: THOMSON PARANINFO,S.A.

ISBN(13): 9788426713612

Title: INSTRUMENTACIÓN INDUSTRIAL (7ª)

Author: Creus Solé, Antonio;

Editorial: MARCOMBO, S.A.

ISBN(13): 9788426713445.

Title: SENSORES Y ACONDICIONADORES DE SEÑAL (4ª).

Author: Pallàs Areny, Ramon.

Editorial: MARCOMBO, S.A.