Course Syllabus (Proyecto/Guía docente de la asignatura)

Subject	INDUSTRIAL INFORMATICS		
Degree	Bachelor of Engineering in Industrial Technologies Industrial Engineering International Semester		
Plan	493	**Code**	46471
Semester	Spring	**Type**	Optional
Level/cycle	Bachelor	**Year**	4th
ECTS	6		
Language	English		
Teaching staff	Eusebio de la Fuente López		
Contact information	efuente@uva.es, 983 423356		
Department	System Engineering and Automation		

1. Sense of the Course (Situación / Sentido de la Asignatura)

1.1 Contextualization (Contextualización)

Industrial Informatics focuses on the analysis, design and development of computer applications that responds to the needs in industrial production. This includes a collection of techniques that use information analysis, manipulation, and distribution to achieve higher efficiency, reliability, and security within the industrial environment.

Industrial Informatics is currently a field that is under a strong development of technologies such as artificial intelligence, robotics, augmented reality and industrial internet of things (IIoT), among others. These technologies are undergoing today such a breakthrough that it has been called the fourth industrial revolution or Industry 4.0. It is crucial for the engineer to understand the possibilities and opportunities that Industry 4.0 brings with it.

1.2 Relationship with other subjects (Relación con otras materias)

This subject is related to the following subjects:

- *Basics of computer programming*. Principles of computer programming and Operating Systems and where the student develops the necessary skills to solve simple problems by performing computer programs.
- *Fundamentals of automatic control*. Basic concepts of dynamic systems, feedback, stability and design of controllers.
- *Production and Manufacturing Systems*. Introduction to industrial communication, robotic technologies and the basic elements of an industrial control system.

1.3 Recommended Prior Knowledge (Prerrequisitos)

Basic knowledge of computer programming is needed. The subject will be taught using Python programming language but knowledge of this specific language is not required initially.

2. Competences

2.1 Generic competences

CG1. Ability to analyze and synthesize.
CG2. Organizational capacity and time planning.
CG5. Ability to learn and work autonomously.
CG6. Problem-solving capability.
CG7. Critical reasoning/logical analysis capability.
CG8. Ability to apply knowledge to practice.
CG9. Ability to work as a team effectively.

2.2 Specific competences

CE2. Advanced knowledge about automation, its components, constraints and control methods.
CE3. Advanced knowledge about computing and its programming in industrial environments: use and programming of computers, operating systems, databases and development environments, etc.
CE5. Knowledge of basic industrial technologies for the proper functioning of any industrial environment.
CE12. Knowledge about the fundamentals of automations and control methods.

3. Course goals

- Contextualize the different **techniques and computer applications in the industrial environment**.
- Analyze, program and design **control systems for industrial applications**.
- Know the fundamentals of **industrial standards for industrial communications** and understand which is best suited for a particular automation application.
- Understand **safety instrumented systems** (**SIS**) and their importance on critical process systems that must keep safe operation when dangerous conditions occur.
- Understand **relational databases and program using SQL language** to manage the large amount of data that manufacturing facilities generate.
- Analyze, program and design **computer vision systems** in the field of industrial inspection and robot guidance.

4. Learning Units

Unit 1: "Industrial Computing"

Workload in credits ECTS (Carga de trabajo en créditos ECTS): 1.6

a. Course goals (Objetivos de aprendizaje)

- Contextualize the different **techniques and computer applications in the industrial environment**.
- Analyze, program and design **control systems for industrial applications**.
- Know the fundamentals of **industrial standards for industrial communications** and understand which is best suited for a particular automation application.
- Understand **safety instrumented systems** (**SIS**) and their importance on critical process systems that must keep safe operation when dangerous conditions occur.

b. Contents (Contenidos)

- Industrial Control Systems
- PLC. General features. Programming
- Distributed control systems
- SCADA systems
- Industrial Communications. Field buses.
- Instrumented security systems

c. Bibliography (Bibliografía)

- Guide to Industrial Control Systems (ICS) Security - Supervisory Control and Data Acquisition (SCADA) systems, Distributed Control Systems (DCS), and ... such as Programmable Logic Controllers (PLC). NIST. CreateSpace Independent Publishing Platform (December 19, 2013) 168 pages
- Ricarda Koch, Ralph Luftner Communication Networks in Automation : Bus Systems. Components. Configuration and Management. Protocols. Security Editorial Publicis MCD Verlag,Germany ISBN10 3895784524 ISBN13 9783895784521 234 páginas

- Paul Gruhn, Harry L. Cheddie, Safety Instrumented Systems: Design, Analysis, and Justification, 2nd Edition 2nd Edition. Publisher : ISA-The Instrumentation, Systems, and Automation Society; 2nd edition (August 22, 2005)

d. Timing (Temporalización)

ECTS	PERIODO PREVISTO DE DESARROLLO
1.6 credits	Theory classes. Weeks 1-6

Unit 2: "Relational Databases. SQL"

Workload in credits ECTS (Carga de trabajo en créditos ECTS): 1.6

a. Course goals (Objetivos de aprendizaje)

Students will be able to understand relational databases and manage them using SQL language to deal with the large amount of data that manufacturing facilities generate.

b. Contents (Contenidos)

- Introduction to databases
- Relational database model
- SQL Structured Querry Language

c. Bibliography (Bibliografía)

- Anthony Molinaro. SQL Cookbook. O'Reilly Media, Inc., 2006 - 595 pages
- Knaflic, C. N. (2015). *Storytelling with data: a data visualization guide for business professionals.* Hoboken, New Jersey: John Wiley & Sons, Inc.
- W. McKinney Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython. O'Reilly Media, 1 edition, (Feb 5, 2013)

d. Timing (Temporalización)

CARGA ECTS	PERIODO PREVISTO DE DESARROLLO
1.6 credits	Lab. Classes. Weeks 1-8

Unit 3: "Computer Vision"

Workload in credits ECTS (Carga de trabajo en créditos ECTS): 2.8

a. Course goals (Objetivos de aprendizaje)

Students will be able to analyze, program and design computer vision systems for image processing in the field of industrial inspection and robot guidance.

b. Contents (Contenidos)

- Components of a industrial vision system
- Setting up openCV
- Image segmentation. Thresholding
- Filtering. Edge extraction
- Custom object detection

c. Bibliography (Bibliografía)

- Joseph Howse, Joe Minichino, Learning OpenCV 4 Computer Vision with Python 3: Get to grips with tools, techniques, and algorithms for computer vision and machine learning, 3rd Edition. Packt Publishing Ltd, 2020. 372 pages

d. Timing (Temporalización)

CARGA ECTS	PERIODO PREVISTO DE DESARROLLO
2.8 credits	Theory and Lab. Classes weeks 8-15

5. Teaching and Learning Methods (Métodos docentes y principios metodológicos)

The course consists of 3 learning units that include theoretical lessons, practices, in-group corrections or checking, concerted tutorials and technical visits.

The lectures will mainly use oral presentation for teaching the fundamental knowledge of the subject. Active student participation will be encouraged.

The practical lessons will support the understanding and assimilation of the concepts provided in theoretical lectures. The assignments will be done individually or in small groups, depending on the activity and the number of students enrolled. Some of the assignments will be done in the classroom and at home. The assignments of each learning unit will be presented to the lecturer and other students and handed in to the teacher within the deadlines indicated in the schedule presented at the beginning of the course.

Tutorials will involve personal assistance and will be carried out individually or in small groups to monitor the proper development of the work prior to final assignment submission. These tutorials should be previously arranged.

6. Dedication of the student to the subject (Tabla de dedicación del estudiante a la asignatura)

PRESENTIAL ACTIVITIES (ACTIVIDADES PRESENCIALES)	HOURS (HORAS)	NON PRESENTIAL ACTIVITIES (ACTIVIDADES NO PRESENCIALES)	HOURS (HORAS)
Unit 1: "Industrial Computing"	16	Student personal work	24
Unit 2: "Relational Databases. SQL"	16	Student personal work	24
Unit 3: "Computer Vision"	28	Student personal work	42
Total presential	**60**	**Total non presential**	**90**

7. Activities evaluated and grading system (Sistema y características de la evaluación)

The grading of students will be held according to the following parameters:

- Exam of the contents presented in lectures: 50%
- Activities and Assignments made in Learning Unit 1: 10%
- Activities and Assignments made in Learning Unit 2: 15%
- Activities and Assignments made in Learning Unit 3: 25%

It is essential to pass each individual unit in order to pass the course.

8. Additional Considerations (Consideraciones finales)

The course is configured in such a way that it requires the presence of the student for its effective use, although videoconference lesson might be implemented if needed. The means of communication with the students will be the subject page on the Virtual Campus of the University of Valladolid. On this page, information will be provided about its development and support material will be published for the teaching given in the classroom. This material can be used as a guide to the subject matter explained, but it is not intended to be exclusive material for study; the student should complete it with his notes and the recommended bibliography.

Course Syllabus Addendum

In the event of a return to a situation of confinement such as that which occurred during the 2019/20 academic year which involves the interruption of classroom activities, an addendum to the current course guide will be drawn up. The content of the addendum will depend on the specific date on which the face-to-face activities will be interrupted and on the computer and telematic means (personal and institutional) provided by the University of Valladolid to the teaching staff to carry out the distance learning activity and which are not known at the date of preparation of this document.

The content of the addendum, which will depend on the two points mentioned above (date of interruption of the face-to-face activities and means provided by the UVa) will contain in a new work plan with its temporalization, adaptation of the contents, teaching methods, adapted table of student dedication, and if necessary also, changes in the evaluation and qualification system.

The proposed changes will guarantee the acquisition of knowledge and the development of the competences stated in the official report of the curriculum.