



## GENERAL INFORMATION

Course information	
Name	Smart Industry I
Code	DOI-MIC-517
Main program	Master's Degree in Smart Industry
Offered in	Máster Universitario en Ingeniería Industrial + Máster en Industria Conectada [1 <sup>st</sup> year]
Level	Master's Degree
Semester	1 <sup>st</sup> (Fall)
Credits	1.5 ECTS
Type	Compulsory
Department	Industrial Organization
Coordinator	Bernardo Villazán Gil

Lecturer	
Name	Bernardo Villazán Gil
Department	Industrial Organization
Office	Chair of Smart Industry (Francisco Ricci, 3)
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Phone	91.542.28.00 – Ext. 4704
Office hours	Arrange an appointment through email.

## COURSE SPECIFIC INFORMATION

Contextualization of the course
<b>Contribution to the professional profile of the degree</b>
<p>The purpose of this course is to provide students with a comprehensive understanding of the smart industry concept, industry levers, and value drivers.</p> <p>By the end of the course, students will:</p> <ul style="list-style-type: none"><li>▪ Know the fundamentals of smart industry.</li><li>▪ Have a complete understanding of the smart industry value chain.</li><li>▪ Visit plant references of smart industries in different sectors.</li><li>▪ Learn from leading industrial companies the roadmap to become smart industries.</li></ul>
<b>Prerequisites</b>
None.



## Competences<sup>1</sup> – Objectives

### Competences

#### General

- CG1. Have acquired advanced knowledge and demonstrated, in a research and technological or highly specialized context, a detailed and well-founded understanding of the theoretical and practical aspects, as well as of the work methodology in one or more fields of study.  
*Haber adquirido conocimientos avanzados y demostrado, en un contexto de investigación científica y tecnológica o altamente especializado, una comprensión detallada y fundamentada de los aspectos teóricos y prácticos y de la metodología de trabajo en uno o más campos de estudio.*
- CG2. Know how to apply and integrate their knowledge, understanding, scientific rationale, and problem-solving skills to new and imprecisely defined environments, including highly specialized multidisciplinary research and professional contexts.  
*Saber aplicar e integrar sus conocimientos, la comprensión de estos, su fundamentación científica y sus capacidades de resolución de problemas en entornos nuevos y definidos de forma imprecisa, incluyendo contextos de carácter multidisciplinar tanto investigadores como profesionales altamente especializados.*
- CG3. Know how to evaluate and select the appropriate scientific theory and the precise methodology of their fields of study in order to formulate judgements based on incomplete or limited information, including, when necessary and pertinent, a discussion on the social or ethical responsibility linked to the solution proposed in each case.  
*Saber evaluar y seleccionar la teoría científica adecuada y la metodología precisa de sus campos de estudio para formular juicios a partir de información incompleta o limitada incluyendo, cuando sea preciso y pertinente, una reflexión sobre la responsabilidad social o ética ligada a la solución que se proponga en cada caso.*
- CG4. Be able to predict and control the evolution of complex situations through the development of new and innovative work methodologies adapted to the scientific/research, technological or specific professional field, in general multidisciplinary, in which they develop their activity.  
*Ser capaces de predecir y controlar la evolución de situaciones complejas mediante el desarrollo de nuevas e innovadoras metodologías de trabajo adaptadas al ámbito científico/investigador, tecnológico o profesional concreto, en general multidisciplinar, en el que se desarrolle su actividad.*
- CG5. Be able to transmit in a clear and unambiguous manner, to specialist and non-specialist audiences, results from scientific and technological research or state-of-the-art innovation, as well as the most relevant foundations that support them.  
*Saber transmitir de un modo claro y sin ambigüedades, a un público especializado o no, resultados procedentes de la investigación científica y tecnológica o del ámbito de la innovación más avanzada, así como los fundamentos más relevantes sobre los que se sustentan.*
- CG7. Being able to take responsibility for their own professional development and their specialization in one or more fields of study.  
*Ser capaces de asumir la responsabilidad de su propio desarrollo profesional y de su especialización en uno o más campos de estudio.*

#### Specific

- CE1. Have an overview of connected industry. Be able to explain in which areas substantial improvements can be obtained by applying digital techniques and technologies.  
*Tener una visión general de la industria conectada. Ser capaces de explicar en qué áreas pueden obtenerse mejoras sustanciales por la aplicación de técnicas y tecnologías digitales.*

<sup>1</sup> Competences in English are a free translation of the official Spanish version.



## Learning outcomes

By the end of the course students should:

- RA1. Understand the basic principles behind smart industry.
- RA2. Be able to conduct research on smart industry topics.
- RA3. Be confident attending professional smart industry forums.
- RA4. Be able to participate in encounters with leading industrial companies.
- RA5. Identify smart industry levers and industrial value drivers.
- RA6. Improve their team working abilities.

## CONTENTS

### Contents

#### Theory

##### Unit 1. Introduction to smart industry

- 1.1 Definition
- 1.2 The 4<sup>th</sup> industrial revolution
- 1.3 Smart industry levers and drivers
- 1.4 Implications

##### Unit 2. Case #1: "Majestic"

- 2.1 Production and quality
- 2.2 Assets and costs

##### Unit 3. Case #2: "Cosentino"

- 3.1 Inventories
- 3.2 Logistic

##### Unit 4. Industry 4.0 technology ecosystem

- 4.1 Collaboration vs. competition
- 4.2 Use cases

##### Unit 5. Case #3: "Zara"

- 5.1 Customer intimacy
- 5.2 Time to market

#### Master classes

##### MC1. IPS

Digital twins in industry

##### MC2. Pernod Ricard

Competitiveness

#### Hackathon (Optional)

VI Hackathon for Smart Industry

## TEACHING METHODOLOGY

General methodological aspects	
Theory and practice will be combined along the course. The teacher will explain the basics of the subject and will go into depth in the more important issues with illustrative examples. Students will form groups to put the proposed methods and techniques in practice in a collaborative way.	
In-class activities	Competences
<ul style="list-style-type: none"> <li>▪ <b>Lectures:</b> The lecturer will introduce the fundamental concepts of each unit, along with some practical recommendations, and will go through worked examples to support the explanation. Active participation will be encouraged by raising open questions to foster discussion and by proposing short application exercises to be solved in class.</li> </ul>	CG1, CG2, CG3, CG4, CG5
<ul style="list-style-type: none"> <li>▪ <b>Master classes:</b> C-Level professionals from diverse industries will share their experiences related to the industry 4.0 paradigm.</li> </ul>	CG7, CE1
<ul style="list-style-type: none"> <li>▪ <b>Hackathon (optional):</b> Students will work in teams to design and build a solution for a real industry challenge. Competition, awards, and networking.</li> </ul>	CG7, CE1
<ul style="list-style-type: none"> <li>▪ <b>Tutoring</b> for groups or individual students will be organized upon request.</li> </ul>	–
Out-of-class activities	Competences
<ul style="list-style-type: none"> <li>▪ Personal study of the course material and resolution of the proposed exercises.</li> </ul>	CG1, CG2, CG3, CG4, CG5, CG7, CE1

## STUDENT WORK-TIME SUMMARY

IN-CLASS HOURS	
Lectures	Master classes
11	4
OUT-OF-CLASS HOURS	
Self-study	
30	
ECTS credits:	1.5 (45 hours)

## EVALUATION AND GRADING CRITERIA

Evaluation activities	Grading criteria	Weight
Final exam	<ul style="list-style-type: none"> <li>▪ Understanding of the theoretical concepts.</li> <li>▪ Application of these concepts to problem-solving.</li> </ul>	50%
Participation	<ul style="list-style-type: none"> <li>▪ Pose questions and make relevant comments.</li> <li>▪ Spark discussion and comments from others.</li> <li>▪ Build on the ideas and contributions of others.</li> <li>▪ Present well-structured arguments.</li> </ul>	50%



Grading
Regular assessment
<ul style="list-style-type: none"> <li>▪ Final exam: 50%</li> <li>▪ Participation: 50%</li> </ul> <p>In order to pass the course, the weighted average mark must be greater or equal to 5 out of 10 points.</p>
Retake
There will be a final exam that will account for 100% of the grade.
Course rules
<ul style="list-style-type: none"> <li>▪ Class attendance is mandatory according to Article 93 of the General Regulations (Reglamento General) of Comillas Pontifical University and Article 6 of the Academic Rules (Normas Académicas) of the ICAI School of Engineering. Not complying with this requirement may have the following consequences:               <ul style="list-style-type: none"> <li>- Students who fail to attend more than 15% of the lectures may be denied the right to take the final exam during the regular assessment period.</li> </ul> </li> <li>▪ Students who commit an irregularity in any graded activity will receive a mark of zero in the activity and disciplinary procedure will follow (cf. Article 168 of the General Regulations (Reglamento General) of Comillas Pontifical University).</li> </ul>

## WORK PLAN AND SCHEDULE

Activities	Date/Periodicity	Deadline
Continuous evaluation activities to review and study the concepts covered in the lectures	Periodically on demand	–
Final exam	Last session (Mid-November)	–
Lectures and master classes	See schedule	–
Review and self-study of the concepts covered in the lectures	After every lesson	–

Session	Duration	Type	Description	Professor
1	2 hours	Lecture	Introduction	Bernardo Villazán
2	2 hours	Lecture	Case #1: Majestic	Bernardo Villazán
3	2 hours	Lecture	Case #2: Cosentino	Bernardo Villazán
4	2 hours	Lecture	Industry 4.0 technology ecosystem	Bernardo Villazán
5	2 hours	Master class	Digital twins in industry	IPS
6	2 hours	Lecture	Case #3: Zara	Bernardo Villazán
7	2 hours	Master class	Competitiveness	Pernod Ricard
Optional	Friday – Saturday	CIC event	VI Hackathon for Smart Industry	CIC
8	2 hours	Lecture & Assessment	Wrap up & test	Bernardo Villazán

## BIBLIOGRAPHY AND RESOURCES

### Basic references

- Slides prepared by the lecturer (available in Moodle).

### Complementary references

- United Nations, *The sustainable development agenda. Sustainable development goals. 17 goals to transform our world*, Sep. 19, 2017, [Online]. Available: <https://www.un.org/sustainabledevelopment>
- World Economic Forum, *The future of jobs: Employment, skills and workforce strategy for the fourth industrial revolution*, Jan. 2016, [Online]. Available: [http://www3.weforum.org/docs/WEF\\_Future\\_of\\_Jobs.pdf](http://www3.weforum.org/docs/WEF_Future_of_Jobs.pdf)

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