COMILLAS
UNIVERSIDAD PONTIFICIA
ICAI ICADE CIHS

COURSE SYLLABUS 2019-2020

GENERAL INFORMATION

Course information	
Name	Smart Industry Applications II
Code	DOI-MIC-522
Degree	Máster Universitario en Ingeniería Industrial + Máster en Industria Conectada [2nd year]
Semester	2nd (Spring)
ECTS credits	3.0
Type	Compulsory
Department	Industrial Organization
Coordinator	Bernardo Villazán Gil

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

DETAILED INFORMATION

Contextualization of the course

Contribution to the professional profile of the degree

The purpose of this course is to provide students with a comprehensive understanding of the applications, levers, and value drivers in relevant industrial sectors.

By the end of the course, students will:

- Have a complete understanding of the dynamics of relevant industrial sectors.
- Be familiar with real experiences and use cases from leading industrial companies.

Prerequisites

None.

CONTENTS

Contents
Theory
Unit 1. Introduction to smart industry applications
1.1 Definition recap 1.2 Applications: “Know why” and “know who” 1.3 Implications
Unit 2. Case #1: “Chemical”
2.1 Manufacturing 2.2 Security
Unit 3. Case #2: “Electronics, Telco and IT”
3.1 Innovation 3.2 Customer experience
Unit 4. Predictive maintenance
4.1 Corrective, predictive and preventive maintenance 4.2 Intelligent maintenance systems
Unit 5. Case #3: “Jamboree”
5.1 Risk management. Key risk indicators 5.2 Risk materialization. Impact and reputation 5.3 Critical and sensitive information leakages 5.4 The economy of platforms
Master classes
MC1. Acerinox
Advanced manufacturing.
MC2. ABB
Advanced robotics and digital twins.
MC3. Telefónica
Innovation and competitiveness.
Mini hackathons
Industry 4.0 applications challenge to be solved in teams.

Competences and learning outcomes

Competences[1]

General competences

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 competences

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.*

[1] Competences in English are a free translation of the official Spanish version.

Learning outcomes
By the end of the course students should:
RA1. Be able to conduct research on smart industry applications.
RA2. Be confident attending professional smart industry applications forums.
RA3. Be able to participate in encounters with leading industrial companies.
RA4. Identify smart industry levers and industrial value drivers.
RA5. Improve their team working abilities.

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
▪ **Lectures:** 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.	CG1, CG2, CG3, CG4, CG5
▪ **Master classes:** C-Level professionals from diverse industries will share their experiences related to the industry 4.0 paradigm.	CG7, CE1
▪ **Mini hackathons (Optional):** Students will compete in teams to solve a real industry challenge. There will be a team award and professional networking.	CG7, CE1
▪ **Tutoring** for groups or individual students will be organized upon request.	–
Out-of-class activities	**Competences**
▪ Personal study of the course material and resolution of the proposed exercises.	CG1, CG2, CG3, CG4, CG5, CG7, CE1

ASSESSMENT AND GRADING CRITERIA

Assessment activities	Grading criteria	Weight
Continuous evaluation	▪ Understanding of the theoretical concepts. ▪ Application of these concepts to problem-solving.	40%
Final exam	▪ Understanding of the theoretical concepts. ▪ Application of these concepts to problem-solving.	60%

GRADING AND COURSE RULES

Grading

Regular assessment

- Continuous evaluation: 40%
- Final exam: 60%

In order to pass the course, the weighted average mark must be greater or equal to 5 out of 10 points.

Retake

There will be a final exam that will account for 100% of the grade.

Course rules

- 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:
  - 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.
- 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).

WORK PLAN AND SCHEDULE

In and out-of-class activities	Date/Periodicity	Deadline
Continuous evaluation activities to review and study the concepts covered in the lectures	Periodically on demand	–
Final exam	Last session	–
Lectures	Weekly	–
Review and self-study of the concepts covered in the lectures	Weekly	–

Date	Time	Type	Description	Professor
14/01/2020	15 – 17h	Lecture	Introduction	Bernardo Villazán
16/01/2020	19 – 21h	Lecture	Case #1: Chemical	Bernardo Villazán
21/01/2020	15 – 17h	Mini hackathon	Industry 4.0 applications challenge	Bernardo Villazán
23/01/2020	19 – 21h	Mini hackathon	Industry 4.0 applications challenge	Bernardo Villazán
28/01/2020	15 – 17h	Lecture	Case #2: Electronics	Bernardo Villazán
30/01/2020	19 – 21h	Master class	Advanced manufacturing	Acerinox
04/02/2020	15 – 17h	Lecture	Predictive maintenance	Bernardo Villazán
06/02/2020	19 – 21h	Lecture	Case #3: Jamboree (I)	Bernardo Villazán
11/02/2020	15 – 17h	Master class	Digital twins	ABB
13/02/2020	19 – 21h	Lecture	Case #3: Jamboree (II)	Bernardo Villazán
18/02/2020	15 – 17h	Master class	Innovation	Telefónica
20/02/2020	19 – 21h	Mini hackathon	Industry 4.0 applications challenge	Bernardo Villazán
25/02/2020	15 – 17h	Mini hackathon	Industry 4.0 applications challenge	Bernardo Villazán
27/02/2020	19 – 21h	Lecture & Test	Wrap up & Final exam	Bernardo Villazán

STUDENT WORK-TIME SUMMARY		
IN-CLASS HOURS		
Lectures	Master classes	Mini hackathons
16	6	8
OUT-OF-CLASS HOURS		
Self-study		
60		
ECTS credits:		3 (90 hours)

BIBLIOGRAPHY

Basic bibliography

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

Complementary bibliography

- J. M. Müller, D. Kiel, and K.-I. Voigt, *What drives the implementation of Industry 4.0? The role of opportunities and challenges in the context of sustainability*, Sustainability, vol. 10, no. 1, pp. 247–270, Jan. 2018, [Online]. Available: https://doi.org/10.3390/su10010247.
- H. Lasi, P. Fettke, H.-G. Kemper, T. Feld, and M. Hoffman, *Industry 4.0*, Business & Information Systems Engineering, vol. 6, no. 4, pp. 239–242, 2014 [Online]. Available: https://aisel.aisnet.org/bise/vol6/iss4/5/
- Y. Liao, F. Deschamps, E. F. R. Loures, and L. F. P. Ramos, *Past, present and future of Industry 4.0 – A systematic literature review and research agenda proposal*, International Journal of Production Research, vol. 55, no. 12, pp. 3609–3629, 2017, [Online]. Available: https://doi.org/10.1080/00207543.2017.1308576