COMILLAS
UNIVERSIDAD PONTIFICIA
ICAI ICADE CIHS

COURSE SYLLABUS 2025-2026

GENERAL INFORMATION

Course information	
Name	Intelligent Industry Applications
Code	DOI-MIINT-525
Main program	Máster en Industria Inteligente
Offered in	Máster Universitario en Ingeniería Industrial + Máster en Industria Inteligente [2nd year] Máster en Industria Inteligente [1st year]
Level	Master's Degree
Semester	2nd (Spring)
Credits	3.0 ECTS
Type	Compulsory
Department	Industrial Organization
Coordinator	Bernardo Villazán Gil

Lecturer	
Name	Bernardo Villazán Gil
Department	Industrial Organization
Office	Chair of Intelligent Industry (Rey Francisco, 4)
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Office hours	Arrange an appointment through email.

COURSE SPECIFIC 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.

Competences[1] – 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.

[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 intelligent industry applications. RA2. Be confident attending professional intelligent industry applications forums. RA3. Be able to participate in encounters with leading industrial companies. RA4. Identify intelligent industry levers and industrial value drivers. RA5. Improve their team working abilities.

CONTENTS

Contents
Theory
Unit 1. Introduction to intelligent industry applications
1.1 Definition recap 1.2 Applications: “Know why” and “know who” 1.3 Implications
Master classes
MC1. Endesa
Energy.
MC2. Centro Español de Logística (CEL)
Logistics 4.0.
MC3. INEA
Agro-industry and food.
MC4. GlaxoSmithKline
Pharmaceutical industry.
MC5. Airbus
Aeronautics.
MC6. SEAT
Automotive industry.
MC7. PackBenefit
Packaging.
MC8. Acerinox
Primary sector: Steel
MC9. Pladur
Construction and buildings.
Mini hackathons
Industry 4.0 application challenges to be solved in teams.

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:** 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

STUDENT WORK-TIME SUMMARY

IN-CLASS HOURS		
Lectures	**Master classes**	**Mini hackathons**
4	18	8
OUT-OF-CLASS HOURS		
Self-study		
60		
ECTS credits:		**3 (90 hours)**

EVALUATION AND GRADING CRITERIA

The use of AI to produce entire assignments or significant parts of them, without citing the source or tool used, or without explicit permission in the assignment description, will be considered plagiarism and will be subject to the University's General Regulations.

Evaluation 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

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).

Guidelines for the use of generative artificial intelligence (AI)

- The responsible use of these tools is encouraged as a means of supporting individual study (e.g., to clarify concepts or receive feedback) and foster in-class discussion. However, students should be aware that responses generated by AI models may contain errors, and it is their responsibility to critically assess and verify the information provided.
- The use of generative artificial intelligence models or programming assistants is strictly prohibited in the exams. These activities must reflect exclusively the student's own knowledge and individual work.

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	–
Lectures	Weekly	–
Review and self-study of the concepts covered in the lectures	Weekly	–

Session	Duration	Type	Description	Professor
1	2 hours	Lecture	Introduction	Bernardo Villazán
2	2 hours	Mini hackathon	Mini hackathon #1	Bernardo Villazán
3	2 hours	Master class	I4.0 in the energy sector	Endesa
4	2 hours	Master class	Logistics 4.0	Centro Español de Logística (CEL)
5	2 hours	Master class	I4.0 in agriculture and food	INEA
6	2 hours	Master class	I4.0 in the pharmaceutical sector	GlaxoSmithKline
7	2 hours	Mini hackathon	Mini hackathon #2	Bernardo Villazán
8	2 hours	Master class	I4.0 in aeronautics	Airbus
9	2 hours	Master class	I4.0 in the automotive sector	SEAT
10	2 hours	Master class	I4.0 in packaging	PackBenefit
11	2 hours	Master class	I4.0 in the primary sector: Steel	Acerinox
12	2 hours	Mini hackathon	Mini hackathon #3	Bernardo Villazán
13	2 hours	Master class	I4.0 in construction and buildings	Pladur
14	2 hours	Mini hackathon	Mini hackathon #4	Bernardo Villazán
15	2 hours	Lecture & Test	Wrap up & Final exam	Bernardo Villazán

BIBLIOGRAPHY AND RESOURCES

Basic references

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

Complementary references

- 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