



IDENTIFYING DATA

Master's thesis

Subject	Master's thesis			
Code	V04M183V01207			
Study programme	M.U. Industry 4.0			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	1st	2nd
Teaching language	Spanish Galician English			
Department				
Coordinator	Cerqueiro Pequeño, Jorge Peláez Lourido, Gustavo Carlos Garrido Campos, Julio			
Lecturers	Cerqueiro Pequeño, Jorge Garrido Campos, Julio Peláez Lourido, Gustavo Carlos			
E-mail	jgarri@uvigo.es gupelaez@uvigo.es jcerquei@uvigo.es			
Web	http://masterindustria40.webs7.uvigo.es/wordpress/			
General description	Elaboration, presentation and defence, after all the credits of the syllabus have been obtained, of an original piece of work made individually, in front of an university board. That work that will have a sufficient entity and will address a problem, development, study, etc. related to the Industry 4.0 paradigm and its facilitating technologies, with a professional approach, and in which the competitions acquired in the courses coalesce.			

Skills

Code	
A2	Students should be able to apply their acquired knowledge and problem-solving skills in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of study.
A3	Students are able to integrate knowledge and deal with the complexity of making judgements based on information which, being incomplete or limited, includes reflections on the social and ethical responsibilities linked to the application of their knowledge and judgements.
A4	Students should be able to communicate their findings - and the ultimate knowledge and reasons behind them - to specialist and non-specialist audiences in a clear and unambiguous manner
B1	Organization and planning skills
B2	Problem solving.
B3	Descion making
B4	Information management capacity.
B5	Oral and written communication in your own language.
B6	Knowledge and use of the English language.
B7	Computer skills related to the field of study.
C1	Knowing the concepts of product life cycle to learn how to apply them with an integral approach, with sustainability criteria through software tools and infrastructure and digital media.
C2	To know and apply the principles and tools of Lean Manufacturing in the processes of design and development of products of the Industry 4.0 to materialize proposals of innovation through concurrent engineering and ICT of collaborative engineering.
C3	Learn the basics of cloud computing, components, tools and its orientation as an Internet-based service.
C4	Know and apply tools and techniques to capture, store, smart analysis and visualize massive data.
C5	To know and know how to implement in the factories the architectures, technologies and protocols used in communication systems and local industrial networks.
C6	Knowing the role of cyber security in the factories of the future, the methods, techniques and limitations to be able to implement safe industrial infrastructures.
C7	To know the fundamentals of Artificial Intelligence and its most important practical applications for its implementation in the design and manufacturing processes.

- C8 Know how to use artificial intelligence methods to model, design and develop applications based on reasoning and inference engines to be implemented in the Industry.
- C9 Know the principles, techniques and systems that comprise the concept of Industrial Internet of Things (IIoT) and its relationship with design and manufacturing
- C10 Knowing how to implement robust, flexible and fault-tolerant industrial control systems, through data acquisition and decision making systems appropriate to each situation.
- C11 Know and use the elements and principles of operation of cyberphysical systems resulting from the integration of physical, computational and communication processes.
- C12 Develop cyberphysical systems for application to product and process solutions in factories, using Systems Engineering procedures.
- C13 Use the integration of different data sources for the definition of flexible, reliable and efficient supply chain management systems, supported by the Industrial Internet of Things and optimized logistics management software tools
- C14 Know the concepts, principles and tools of intelligent manufacturing systems, which facilitate access to information and production data through automated tools for capturing, processing and displaying information
- C15 To know and apply the additive manufacturing technologies, the materials used and the application strategies in the design and manufacture of products.
- C16 Develop models, mock-ups and prototypes using additive manufacturing techniques and tools
- C17 Know the advanced techniques and tools of metrology, calibration and accreditation.
- C18 Develop advanced dimensional verification strategies for application to components and products in the connected industry
- C19 To know, use and know how to implement principles, applications, components, instrumentation and installations of advanced robotic systems for industry.
- C20 To know and know how to apply principles, techniques and equipment of immersion in virtual, augmented and hybrid reality for its implementation in the industry
- C21 To know and be able to use modeling and simulation tools by finite elements, finite differences and computerized fluid dynamics (CFD) as tools of Assisted Engineering (CAE)
- C22 Select the appropriate finite element difference (FEM) and computerized fluid dynamics (CFD) modeling and simulation tools to solve design and manufacturing engineering problems
- C23 Know and select the most suitable advanced CAD/CAM/CAE environments to be integrated and implemented in the Industry.
- C24 Knowing how to apply advanced design, manufacturing and engineering tools to the modeling and manufacturing of complex mechanical parts and assemblies in the industry
- C25 Know and be able to use techniques and tools for mathematical modeling and simulation of discrete event systems and dynamic systems for application in production environments.
- C26 Apply simulation tools to solve specific problems in plant management and integrate them into the implementation process of the 4.0 paradigms.
- C27 To know and apply the engineering techniques and tools for the industrialization of the product in Lean contexts
- C28 Developing strategies for the use of innovation capacity in design and manufacturing in industrial companies
- C29 To know and integrate rigorously the procedures and techniques necessary for the elaboration and implementation of research, development and innovation projects in the context of Industry 4.0
- C30 To develop critical/self-critical and communication skills in a research project, with excellence and quality criteria in national and international fields
- C31 Know the advanced computer tools for mathematical calculation and their use in design and manufacturing engineering applications
- C32 Select and apply advanced calculation tools for solving mathematical problems in the field of design engineering and manufacturing
- C33 Identify and develop key skills and abilities in multidisciplinary teams for the processes of implementation and evolution towards industry 4.0
- C34 Develop skills for competency-based management of people in high-performance teams in the context of Design and Manufacturing
- D1 Ability to understand the meaning and application of the gender perspective in different areas of knowledge and in professional practice with the aim of achieving a more just and equal society
- D2 Incorporate criteria of sustainability and environmental commitment into professional practice. To acquire skills in the equitable, responsible and efficient use of resources
- D3 Multidisciplinary teamwork
- D4 Initiative and entrepreneurial aptitudes and attitudes.

Learning outcomes

Expected results from this subject

Training and Learning Results

Knowing and applying an appropriate methodology for the development of R+D+i projects and activities. A2
B1
B2
B3
B4
C1
C2
C14
D2
D3
D4

Using ICT tools in SMARTCloud, BPM, PLM, videoconferencing or other environments that allow the sharing of information and communication between the student and his/her tutor(s). A4
B5
B6
B7
D1
D3

Search, arrangement and structuring of information about any subject matter. A3
B1
B4
B5
B6
B7
D1
D2
D3

Elaboration of a report that addresses, among others, the following aspects: backgrounds, issues or state of the art, objectives, phases of the project, development of the project, conclusions and future lines of work.

A2
A3
A4
B1
B2
B3
B4
B5
B6
B7
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
C13
C14
C15
C16
C17
C18
C19
C20
C21
C22
C23
C24
C25
C26
C27
C28
C29
C30
C31
C32
C33
C34
D2
D3
D4

Elaboration of scientific-technical documents for the communication and exhibition of the work done.

A3
A4
B1
B3
B4
B5
B6
B7
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
C13
C14
C15
C16
C17
C18
C19
C20
C21
C22
C23
C24
C25
C26
C27
C28
C29
C30
C31
C32
C33
C34
D1
D2
D3

Design of equipment, prototypes, simulation programs, cloud applications, etc., according to project specifications and/or needs.

- A2
- A3
- B1
- B2
- B3
- B4
- B7
- C1
- C2
- C3
- C4
- C5
- C6
- C7
- C8
- C9
- C10
- C11
- C12
- C13
- C14
- C15
- C16
- C17
- C18
- C19
- C20
- C21
- C22
- C23
- C24
- C25
- C26
- C27
- C28
- C29
- C30
- C31
- C32
- C33
- C34
- D2
- D3
- D4

Application and extension of the knowledge acquired in various subjects for the elaboration of the work.

- A2
- A3
- B1
- B2
- B3
- B4
- B5
- B6
- B7
- D1
- D2
- D3
- D4

Contents

Topic

1. Classical Engineering projects.	1.1. Classical Engineering projects.
2. Technical, organisational and economic studies.	2.1. Technical, organisational and economic studies.
3. Theoretical and experimental work.	3.1. Theoretical and experimental work.
4. Works in R+D+i environments.	4.1. Works in R+D+i environments.

Planning

	Class hours	Hours outside the classroom	Total hours
Project based learning	3	101	104
Mentored work	6	15	21
Portfolio/dossier	1	21	22
Essay	1	0	1
Presentation	1	0	1
Portfolio / dossier	1	0	1

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Project based learning	Carrying out activities that allow the cooperation of several subjects so that the students confront, working in teams, some open problems. They will allow to train, among others, the capabilities for cooperative learning, leadership, organization, communication and the strengthening of personal relationships.
Mentored work	The student, individually or in groups, either elaborates a document on the subject matter, or prepares seminars, research, reports, essays, summaries of readings, conferences, etc.
Portfolio/dossier	Compilation of the student's work aiming to demonstrate his/her efforts, progress and achievements in an subject area. That collection should include content chosen by the student, selection criteria and evidence of self-reflection.

Personalized assistance

Methodologies	Description
Project based learning	Carrying out activities that allow the cooperation of several subjects so that the students confront, working in teams, some open problems. They will allow to train, among others, the capabilities for cooperative learning, leadership, organization, communication and the strengthening of personal relationships. For all the teaching modalities contemplated in the Contingency Plan, the tutoring sessions may be carried out by telematic means -e-mail, videoconference, FAITIC forums, etc.- under the modality of prior arrangement of virtual place, date and time.
Mentored work	The student, individually or in groups, either elaborates a document on the subject matter, or prepares seminars, research, reports, essays, summaries of readings, conferences, etc.

Assessment

Description	Qualification	Training and Learning Results

Essay	A text prepared on a subject and which must be written in accordance with established rules.	50	A2 A3 A4	B1 B2 B3 B4 B5 B6 B7	C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11 C12 C13 C14 C15 C16 C17 C18 C19 C20 C21 C22 C23 C24 C25 C26 C27 C28 C29 C30 C31 C32 C33 C34	D1 D2 D3 D4
Presentation	Presentation by the student to the teacher(s) of a subject, about the contents of that subject or about the results of a work.	40	A4	B1 B4 B5 B6 B7		D1 D2 D3
Portfolio / dossier	Compilation of the student's work aiming to demonstrate his/her efforts, progress and achievements in a subject area. That collection should include content chosen by the student, selection criteria and evidence of self-reflection.	10	A3 A4	B1 B4 B5 B6 B7		D1 D2 D3 D4

Other comments on the Evaluation

The students that do not pass the course in the 'continuous assessment' modality in the ordinary evaluation period will be given the chance to attend the final course exams.

Ethical commitment: Students are expected to behave ethically. If unethical behaviour is detected (copying, plagiarism, use of unauthorised electronic devices,...), the student will be considered to be ineligible to pass the subject. Depending on the type of unethical behaviour detected, it could be concluded that the student has not reached the necessary skills to overcome the subject. Students are expected to behave in a respectful and dignified manner and to collaborate with the teaching system, teaching staff, coordination and administrative and services personnel of the Master's degree. Any question due to the lack of ethical and dignified behaviour of the student body may have repercussions on the evaluation of the subject.

Sources of information

Basic Bibliography

AENOR, **UNE 157001: Criterios generales para la elaboración formal de los documentos que constituyen un proyecto técnico**, AENOR, 2014

Universidade de Vigo. EEI, **Recomendaciones generales para la elaboración de TFG/TFM**, 1ª, EEI-Vigo, 2016

Complementary Bibliography

UNE, **UNE 1039: Dibujos técnicos. Acotación. Principios generales, definiciones, métodos de ejecución e indicaciones especiales**, AENOR, 1994

Recommendations

Other comments

The communication with the students will be made through the FAITIC distance learning platform, for which it will be necessary that the student accesses the course space in the platform previously to the start of the lecturing period.

Before the realisation of the evaluation tests, it is recommended that the students consult with the FAITIC platform to confirm the tests' date, place, recommendations, etc., as well as the needs regarding using manuals or any another material for carrying out the tests and elaborating the home assignment works.

Contingency plan

Description

In the face of the uncertain and unforeseeable evolution of the health alert caused by COVID-19, University of Vigo has established an exception planning that will be activated at the time the government offices and the own University mandate it. Such decision will be made based on safety, health and responsibility criteria, always guaranteeing the continuity of the teaching processes in a partial or full non-classroom scenario. Those already-planned steps will guarantee, at the moment it is required, the development of the teaching processes in a more streamlined and effective way as both the students and the lecturers will know about them beforehand (or with a broad anticipation), by means of the DOCNET standard institutional tool.

According to the instructions provided by the Vice-Rectorate for Learning Organization and Teaching Staff, the following three scenarios are required to be taken into account with their corresponding contingency level:

SCENARIO 1. Full-classroom modality.

All teaching activities will be carried out at the classroom, both for theory and laboratory classes, according to the typical way for the course in the years before 2020.

SCENARIO 2. Half-classroom modality.

In the case the half-classroom teaching modality is activated by the University government, such event will involve a reduction in the capacity of the usual teaching spaces where the full-classroom modality is developed. Because of that, as a first measure the School will provide the teaching staff of the course with the information regarding the new authorized capacities for such teaching spaces so that the teaching activities can be re-organized for the remaining time of the term. It must be pointed out that the necessary re-organization to implement will depend on the specific moment in the term in which this teaching modality is activated. The following guidelines will be followed in the re-organization or the teaching activities:

a) Communication. All students in the course will be informed through the FAITIC teaching portal on the specific conditions for the development of the teaching and the evaluation activities that remain until the end of the term.

b) Adaptation of the tutorial and personalized attention to students. The tutorial sessions may be carried out by means of IT tools (email, video-call, FAITIC forums, etc.), according to the modality of prior concertation of the date and time for the session in the lecturers' virtual offices.

c) Classroom and non-classroom activities. From the teaching activities that remain until the end of the term, those that could be carried out by all students in class need to be identified (prioritizing laboratory activities when possible), and those other that will be carried out remotely (theory classes are the ones that usually decrease in effectiveness less in this modality), to the effects of the planning of its efficient performance.

d) Teaching contents and learning goals. There will be no changes neither in the contents to be taught nor in the learning goals, as a consequence of this teaching modality.

e) Teaching schedule. The class timetable and the calendar of the different activities in the course will be maintained as

initially planned and scheduled.

f) Bibliography or additional materials to facilitate self-learning. The teaching staff for the course will provide the students with the necessary learning materials to attend to the specific help needs of the students with respect to the course, according to the circumstances that turn out at any particular time, through the FAITIC portal.

With regard to the tools used for the teaching activities in the non-classroom modality, the CAMPUS REMOTO and FAITIC portals will be of preferential use, complemented if necessary with other solutions in order to address specific needs arising along the lecturing period.

SCENARIO 3. Non-classroom modality.

In the case the full non-classroom modality (discontinuation of all on-class learning and evaluation activities) is activated, the tools offered by the platforms currently available at University of Vigo -CAMPUS REMOTO and FAITIC- will be of preferential use. The specific conditions for the re-organization to be carried out will depend of the particular time in the term in which such modality is mobilized. The following guidelines will be followed in the re-organization of the teaching activities:

a) Communication. All students in the course will be informed through the FAITIC teaching portal on the specific conditions for the development of the teaching and the evaluation activities that remain until the end of the term.

b) Adaptation and/or modification of the teaching methodologies. Even if the teaching methodologies for the course were fundamentally conceived towards the full-classroom modality, the teaching staff considers that they keep in essence their effectiveness in the non-classroom modality. That is why it is proposed to keep them as they are, even if special attention will be payed to their right development and results. Therefore, no changes will be made to the teaching methodologies initially defined for the course.

c) Adaptation of the tutorial and personalized attention to students. The tutorial sessions may be carried out by means of IT tools (email, video-call, FAITIC forums, etc.), according to the modality of prior concertation of the date and time for the session in the lecturers' virtual offices.

d) Teaching contents and learning goals. There will be no changes neither in the contents to be taught nor in the learning goals, as a consequence of this teaching modality.

e) Teaching schedule. The class timetable and the calendar of the different activities in the course will be maintained as initially planned and scheduled.

f) Evaluation. No changes will be made neither to the evaluation tests, nor to their corresponding score weights, nor to their set dates.

g) Bibliography or additional materials to facilitate self-learning. The teaching staff for the course will provide the students with the necessary learning materials to attend to the specific help needs of the students with respect to the course, according to the circumstances that turn out at any particular time, through the FAITIC portal.
