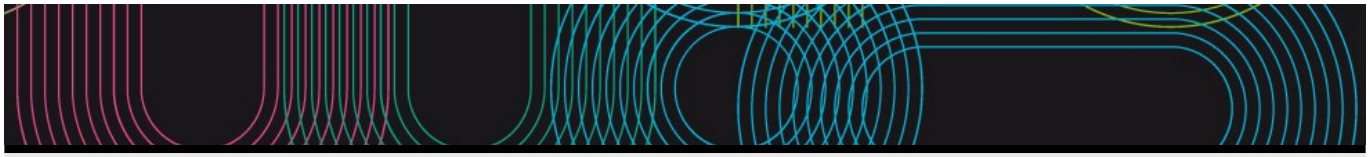

IDENTIFYING DATA

Master's thesis

Subject	Master's thesis			
Code	V04M183V01207			
Study programme	Máster Universitario en Industria 4.0			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	1st	2nd
Teaching language	Spanish Galician English			
Department				
Coordinator	Peláez Lourido, Gustavo Carlos			
Lecturers	Alegre Gutiérrez, Enrique Alfageme González, Norberto Areal Alonso, Juan José Barreiro García, Joaquín Bua Domínguez, José María Castro Sastre, Mª Ángeles Cerqueiro Pequeño, Jorge Comesaña Campos, Alberto Conde González, Miguel Ángel Domínguez González, Manuel Fernández Abia, Ana Isabel Fernández Llamas, Camino Fernández Robles, Laura Fidalgo Fernández, Eduardo Garrido Campos, Julio Giganto Fernández, Sara González Castro, Víctor González Cespón, José Luis Graña Escalante, Roberto Karkkainen , Tatja Lamilla Curros, Francisco Abelardo Larsson , Olof Christian Martínez Martínez, David Mártínez Pellitero, Susana Moreno Collado, Ana María Naderi , Mahdi Peláez Lourido, Gustavo Carlos Pereira Domínguez, Alejandro Pérez García, Hilde Prada Medrano, Miguel Ángel Riveiro Fernández, Enrique Rodríguez Barbosa, Cristian Rodríguez de Soto, Adolfo Rodríguez Lera, Francisco Javier Santos Esterán, David Soto Campos, Enrique Suárez Alonso, Ramón Carlos Tjahjono , Benny Eko Vidal Vázquez, Ricardo Villar García, Marcos			
E-mail	gupelaez@uvigo.gal			
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 facllitating 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 actitudes.

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 capabilitiies 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 capabilitiies 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

UNE-EN ISO, **Especificación geométrica de productos (GPS). Tolerancia geométrica. Tolerancias de perfiles (ISO 1660:2017)**, AENOR, 2017
Mª Luisa Rodriguez i Juan Llanes, **Cómo elaborar, tutorizar y evaluar un Trabajo de Fin de Máster**, 1ª, AQU, 2013

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.