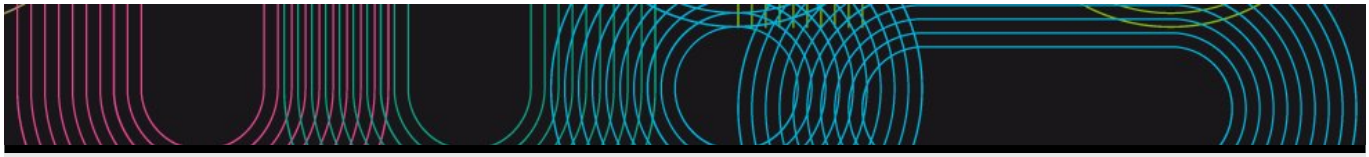

IDENTIFYING DATA				
Industrial Design				
Subject	Industrial Design			
Code	V04M141V01314			
Study programme	(*)Máster Universitario en Enxeñaría Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	2nd	1st
Teaching language	English			
Department				
Coordinator	Cerqueiro Pequeño, Jorge			
Lecturers	Cerqueiro Pequeño, Jorge			
E-mail	jcerquei@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	This course aims to train students to make use of the methods, techniques and basic tools of both the industrial design and the development of industrial products processes. Students will also acquire the skills needed to perform their professional activities with an up-to-date approach, oriented to the the needs of the modern manufacturing industry in terms of innovation, competitiveness and contribution to value generation. This course will make use of an approach that integrates its separated parts: Design of Product and Industrial Design, Design Techniques and Tools for Design, Design Evaluation, and Design Communication, using active methodologies, and highlighting practice learning and real-case studies. Additionally, a multidisciplinary and collaborative approximation will be maintained with the other courses in the orientation, encouraging team work, and following processes similar to the actual professional ones. Commitment and proactive participation of students in all course activities will be promoted and required.			

Training and Learning Results	
Code	
A1	Knowledge and understanding that provide a basis or opportunity for originality in developing and / or applying ideas, often in a research context.
A2	That the students can apply their knowledge and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study.
A3	That students are able to integrate knowledge and handle complexity and formulate judgments based on information that was incomplete or limited, include reflecting on social and ethical responsibilities linked to the application of their knowledge and judgments.
A4	Students can communicate their conclusions, and the knowledge and rationale underpinning these, to specialist and non-specialist audiences clearly and unambiguously.
A5	Students must possess the learning skills that enable them to continue studying in a way that will be largely self-directed or autonomous.
C1	CET1. Project, calculate and design products, processes, facilities and plants.
C3	CET3. Conduct research, development and innovation in products, processes and methods.
C7	CET7. Apply their knowledge and solve problems in new or unfamiliar environments within broader contexts and multidisciplinary environments.
C8	CET8. Being able to integrate knowledge and handle complexity and formulate judgments based on information that was incomplete or limited, include reflecting on social and ethical responsibilities linked to the application of their knowledge and judgments.
C9	CET9. Knowing how to communicate the conclusions -and the knowledge and rationale underpinning these, to specialist and non-specialist audiences clearly and unambiguously.
C10	CET10. Possess learning skills that will allow further study of a self-directed or autonomous mode.
D2	ABET-b. An ability to design and conduct experiments, as well as to analyze and interpret data.
D3	ABET-c. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

D4	ABET-d. An ability to function on multidisciplinary teams.
D5	ABET-e. An ability to identify, formulate, and solve engineering problems.
D8	ABET-h. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
D10	ABET-j. A knowledge of contemporary issues.

Expected results from this subject

Expected results from this subject	Training and Learning Results
Become acquainted with the design methodology, and acquire criteria for the selection of tools and appropriate techniques for any case that arises.	A2 C1 C7 D3 D5
Acquire knowledge about and control of the different factors that play a role in a product life cycle.	A3 C7 C8 D2 D8 D10
Develop capabilities to conceive and materialize inventive solutions to actual problems that are satisfactory for the users.	A1 A5 C3 C7 C10 D3 D8
Gain abilities to make good use of the available resources for product communication and corporate image strengthening.	A4 C9 D4 D8 D10

Contents

Topic	
1. Industrial Design: Its nature and evolution.	1.1. The Design concept. 1.2. Theories on Design. 1.3. History of Industrial Design. 1.4. Elements of Industrial Design.
2. The industrial product.	2.1. The "industrial product" concept. 2.2. Typology of industrial products. 2.3. The product life cycle. 2.4. Product planning. 2.5. Identification of opportunities. 2.6. Detection of user needs. 2.7. Elaboration of technical specifications. 2.8. Initial product documentation.
3. Functional design and Systems Engineering.	3.1. Product functions. 3.2. Principles of functional design. 3.3. The functional design process. 3.4. Techniques for functional design. 3.5. Systems Engineering. 3.6. Functional design documentation. 3.7. Computer tools for functional design.
4. The Product Design and Development Process.	4.1. Objectives and stages in the Product Design and Development Process. 4.2. Project methods in the Product Design and Development Process. 4.3. Factors and strategies in the PDDP: analysis and synthesis. 4.4. Concept Development. 4.5. System-level Design. 4.6. Detail Design. 4.7. PDM-PLM systems.

5. Support tools for the Product Design and Development Process.	5.1. Quality Function Deployment (QFD). 5.2. TRIZ. 5.3. Value Analysis. 5.4. Robust Design. 5.5. Axiomatic Design. 5.6. Design by factors (DfX) approaches. 5.7. The Kano Model of user satisfaction. 5.8. Techniques for cost estimating. 5.9. Reverse engineering. 5.10. Additive manufacture/Rapid prototyping. 5.11. Virtual and augmented reality.
6. Ergonomics in design.	6.1. The Ergonomics concept. 6.2. Ergonomics factors in design. 6.3. Regulations about Ergonomics. 6.4. Techniques for the application of Ergonomics in the product design process. 6.5. Ergonomic evaluation of products. 6.6. Ergonomics in CAD systems.
7. Sustainability in design.	7.1. The sustainability concept. 7.2. Sustainability metrics. 7.3. Components in sustainability. 7.4. Regulations about sustainability. 7.5. Eco-design. 7.6. Life-Cycle Analysis (LCA). 7.7. Sustainability in CAD systems.
8. Tolerances: Cost and optimization.	8.1. Typology of tolerances and relationships between them. 8.2. Specification of tolerances. 8.3. Tolerance design. 8.4. Cost of tolerances. 8.5. Optimization of tolerances. 8.6. Tolerances in CAD systems.
9. Design of moulds and shaping toolings.	9.1. Types of moulds. 9.2. Elements of a mould. 9.3. Techniques for mould design. 9.4. Practical aspects in mould design. 9.5. Types of toolings and their elements. 9.6. Strategies for designing toolings. 9.7. Practical aspects in toolings design. 9.8. Simulation of moulds and toolings. 9.9. CAD tools for designing moulds and shaping toolings.
10. Other idea sources for concept design.	10.1. Industrial property documentation. 10.2. Creativity techniques. 10.3. Bionics. 10.4. Gestalt theory. 10.5. Semiotics and semantics. 10.6. Useful computer tools.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	29.5	44.25	73.75
Laboratory practical	29.5	44.25	73.75
Case studies	1.3	0	1.3
Problem and/or exercise solving	1.2	0	1.2

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

Methodologies

	Description
Lecturing	Presentation by the lecturer of the contents of the topic to be studied, the theoretical bases and/or guidelines of a specific work, exercise or project to be developed by the student.
Laboratory practical	Activities that require applying theoretical knowledge to specific situations in order to acquire basic and procedural skills related to the topic that is being studied. These activities will be developed in special spaces with specific equipment (laboratories, computer rooms, etc.).

Personalized assistance

Methodologies	Description
Laboratory practical	Activities oriented to the application of knowledge to specific situations, and to acquire basic and procedimental skills related to the field of study. Rooms equiped with specific materials and resources will be used for these classes. An appropriate follow-up will be performed on student's work to verify that the best practices shown in theory classes are applied, and that the procedimental recommendations provided by the lecturer are followed. For all the teaching modalities considered in the Contingency Plan, the tutorial sessions can be carried out using IT tools (email, video-call, FAITIC forums, etc.) according to the modality of prior concertation of the virtual place, date and time.

Assessment

	Description	Qualification	Training and Learning Results		
Lecturing	Questionnaire for the evaluation of the understanding by the student of the main theory concepts explained in the sessions.	25	A1 A2 A3 A4 A5	C1 C3 C7 C8 C9 C10	D2 D3 D4 D5 D8 D10
Laboratory practical	Interdisciplinary exercises and problems -as close to real cases as possible- will be solved in groups of students, with lecturer orientation and enforcing active participation by the students.	35	A1 A2 A3 A4 A5	C1 C3 C7 C9 C10	D2 D3 D4 D5 D8 D10
Case studies	Presentation and comment of case studies related with the course, in a group between professor and students, in order to apply the theory contents of the matter.	20	A2 A4	C1 C7 C9	D3 D5 D10
Problem and/or exercise solving	Groups of short answer questions related to the subject's contents, to check that the students have understood and assimilated the theoretical and practical contents.	20	A2 A4	C1 C7 C9	D3 D5 D10

Other comments on the Evaluation

In the 'continuous evaluation' modality, the students will pass the course if they reach a score of 5.0 points. A minimum score of 50% of the maximum grade is required for each part and section. The 'continuous evaluation' will consolidate the partial marks, and the students are required to repeat only the failed parts across the continuous evaluation process.

Students wishing to improve their continuous -pass- evaluation grade can do the full official final exam as well. The students that failed the course in the first official date must do a final test that will encompass the whole of the -theory and practiical- course contents, that might include short- and long-answer tests, problem-solving and case study development.

An appropriate ethical behaviour is expected from the student. In the case that a non-ethical -copying, plagiarism, use of unauthorized electronic devices, among others- it will be considered that the student does not meet the necessary requirements to pass the course. In this case the overall grade for the course in the present academic year will be a fail (0.0). Except in the case of specific authorization, no electronic devices will be allowed for the students to use during the evaluation tests. The act of being in posession of a non-authorized device while in the exam room will be taken as a cause for not passing the course in the current academic year, and the overall grade will be a fail (0.0).

Sources of information

Basic Bibliography

ULLMAN, David G., **The Mechanical Design Process**, 5th, McGraw-Hill, 2015

Complementary Bibliography

BASIC SOURCES:, **----------**, ----------,

HIRZ, Mario; DIETRICH, Wilhelm; GFRERRER, Anton; LANG, Johann, **Integrated Computer-Aided Design in Automotive Development: Development Processes, Geometric Fundamentals, Methods of CAD, Knowledge-Based Engineering Data Management.**, 1st, Springer, 2013

MITAL, Anil; DESAI, Anoop; SUBRAMANIAN, Anand; MITAL, Aashi, **Product development: A structured approach to design and manufacture**, 1st, Butterworth-Heinemann, 2008

ULRICH, Karl T.; EPPINGER, Steven D., **Product Design and Development**, 5th, McGraw-Hill, 2012

YANG, Kai, **Voice of the customer: Capture and analysis**, 1st, McGraw-Hill Professional, 2007

COMPLEMENTARY SOURCES:, **----------**, ----------,

EHRLENSPIEL, Klaus; KIEWERT, Alfons; LINDEMANN, Udo, **Cost-Efficient Design**, 6th, Springer-Verlag, 2007

MAO, Xiaoming, **The framework of TRIZ-enhanced-Value Engineering analysis and its knowledge management**, 1st, University of Alberta, 2008

NEUMANN, Frank, **Analyzing and Modeling Interdisciplinary Product Development: A Framework for the Analysis of Knowledge Characteristics and Design Support**, 1st, Springer, 2015
NORMAN, Donald A., **The Design of Everyday Things, Revised and Expanded Edition**, 2nd, Basic Books, 2013
SUH, Nam P., **Axiomatic Design. Advances and applications**, 1st, Oxford University Press, 2001
WEISS, Stanley I., **Product and systems development: A Value approach**, 1st, John Wiley and Sons, 2013

Recommendations

Subjects that are recommended to be taken simultaneously

Advanced Manufacturing Engineering/V04M141V01321
Systems Engineering and Automation/V04M141V01344
Means, Machines and Tools for Manufacturing/V04M141V01333
Laser Technology Applied to Industrial Production/V04M141V01339
Technologies for Communication and Improving Design/V04M141V01327

Other comments

Previously to the realisation of the final assesments, students should check in the FAITIC platform to know whether it is necessary for them to carry any particular documentation, materials, etc. into the exam room to perform the tests.

It is necessary that the student registered in this course, either has passed all courses of the former years, or is registered in the courses he's not passed yet.