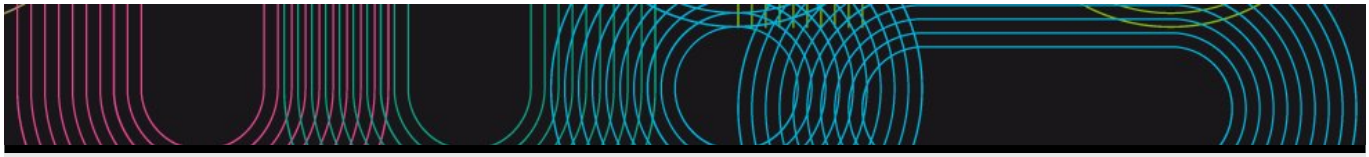

IDENTIFYING DATA				
Industrial Design				
Subject	Industrial Design			
Code	V04M141V01314			
Study programme	(*)Máster Universitario en Enxeñaría Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	2nd	1st
Teaching language	English			
Department				
Coordinator	Cerqueiro Pequeño, 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.			

Skills	
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.

Learning outcomes

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
Laboratory practice	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		
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.	60	A1 A2 A3 A4 A5	C1 C3 C7 C9 C10	D2 D3 D4 D5 D8 D10
Laboratory practice	Making of practical tests and exercises related to the subject's contents, in the scope of the subject's final assessment.	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

Assessment of student's work - individually and/or in groups, either face-to-face or non-presential - will be carried out by the lecturer by weighting appropriatelly the different marks obtained in the activities that were proposed along this course.

Students may opt to follow this course either in the 'Continuous Evaluation' or in the 'Non-Continuous Evaluation' modalities. In both cases the grading of the course will be made according to a numerical system, using values from 0,0 to 10,0 points according to the current laws that are applicable (R.D. 1125/2003 of 5th September, BOE Nr. 224 of 18th September). A minimum overall mark of 5,0 is required to pass this course.

For the First Announcement or Edition.

a) 'Continuous Evaluation' modality:

The final grade for the course will be calculated by combining the individual marks awarded in the assessment of the works proposed and elaborated in the practical classes (60% weight) along the course, with the mark awarded for the final test performed in the date stated by the School's Ruling (40% weight).

Those marks will asess the behaviour and the implication of the student both in class and in the realisation of the different programmed activities, plus the fulfillment of the deadlines for submitting the works that were proposed, and/or the presentation and defence of those works, etc.

Students not reaching the minimum value of 3,5 points out of 10.0 that are required for every section, they will either need to perform also the assessment in the Second Announcement date, or to elaborate additional works or practical exercises to achieve the learning goals that were established for the concerned sections.

b) 'Non-Continuous Evaluation' modality:

There is a two-week time period after the starting date of the course for the concerned students to justify with documents that it is not possible for them to follow the regular process of continuous evaluation.

In order to pass this course, students renouncing to continuous evaluation will be obligued to perform a final test covering the whole contents of the course, both theoretical and practical, including short questions, reasoning questions, problem solving and development of practical cases. The mark awarded to the student assessment will be the final grade for the course.

A minimum mark of 5.0 points out of 10.0 possible will be required to pass the course.

For the Second Announcement or Edition.

Students who did not pass the course in the First Announcement, but that could have passed some specific parts of the

theory or practical blocks, will be allowed to be assessed only regarding the failed parts, keeping the marks formerly awarded for the parts already passed, and applying the same assessment criteria to them.

Students wishing to improve their qualification, or students that failed the course on the First Announcement, will need to assist to the Second Announcement, where they will be assessed about the whole contents of the course, both theoretical and practical, including short questions, reasoning questions, problem solving and development of practical cases. Students are required to reach a minimum mark of 5.0 points out of 10.0 possible to pass the course.

Ethical commitment:

It is expected an appropriate ethical behaviour of the student. In case of detecting unethical behaviour (copying, plagiarism, unauthorized use of electronic devices, etc.) shall be deemed that the student does not meet the requirements for passing the subject. In this case, the overall grade for the course in the current academic year will be 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.

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 preferent use. The specific conditions for the reo-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.