



IDENTIFYING DATA

CAD / CAM / CAE Advanced Systems

Subject	CAD / CAM / CAE Advanced Systems			
Code	V04M183V01107			
Study programme	M.U. Industry 4.0			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Mandatory	1st	1st
Teaching language	Spanish Galician English			
Department				
Coordinator	Cerqueiro Pequeño, Jorge			
Lecturers	Cerqueiro Pequeño, Jorge Pereira Domínguez, Alejandro Villar García, Marcos			
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General description	The aim of this course is to train the students in the selection of the most suitable CAD, CAM and CAE systems according to the specific case of application, in the frame of the Industry 4.0 paradigm.			

The course will make the students to get involved in the practical use of the different tools available within those systems, allowing them to explore their capabilities and limitations, going all the way to the elaboration of benchmarking analysis and specification documents about such systems.

Skills

Code	
A1	Possess and understand knowledge that provides a basis or opportunity to be original in the development and/or application of ideas, often in a research context
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.
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
B3	Decision making
B7	Computer skills related to the field of study.
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
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

Learning outcomes

Expected results from this subject	Training and Learning Results
Knowing the most appropriate CAD/CAM/CAE environments to be implemented in the context of Industry 4.0.	A1 B1 B7 C23

Selecting the appropriate CAD/CAM/CAE solutions to be implemented in response to specific demands, including the design and definition of integrated design and manufacturing systems.	A2 B1 B3 C24 D1 D2
Applying advanced design and engineering tools to the modelling of complex mechanical parts and assemblies.	A2 B3 B7 C24 D1 D2
Applying advanced computer-assisted manufacturing and production engineering tools within the Industry 4.0 framework.	A2 A4 B1 B3 C23 C24 D1 D2

Contents

Topic	
1. CAD/CAM/CAE systems in Industry 4.0.	1.1. Engineering processes in Industry 4.0. 1.2. CAx functionalities in Industry 4.0.
2. Integrated design and manufacturing systems.	2.1. Integration of systems. 2.2. CAx integrated systems -PDM and PLM- for design and manufacturing.
3. Solid modelling (CAD) systems oriented to the product.	3.1. Hierarchies of entities in 3D CAD systems. 3.2. Parametric solid modelling. 3.3. Product structure. 3.4. The 'design intent'. 3.5. Elaboration of technical documentation.
4. Computer-aided manufacturing (CAM) systems.	4.1. Typologies of CAM systems. 4.2. CAM systems to support different manufacturing processes. 4.3. CAD-CAM connectivity for product engineering.
5. Computer-aided engineering (CAE) systems.	5.1. Typologies of CAE systems. 5.2. CAE systems for supporting design. 5.3. CAE systems for manufacturing support. 5.4. CAD-CAM-CAE connectivity.
6. Applications of CAD-CAM-CAE systems.	6.1. Applications of CAD systems to design. 6.2. Applications of CAM systems to manufacturing. 6.3. Applications of CAE systems to engineering.
7. Selection of AD-CAM-CAE systems.	7.1. Evaluation of engineering needs and elaboration of technical specifications. 7.2. Analysis of CAx systems specifications. 7.3. Methodology for the selection of CAx systems.
Practical exercise nr. 1.	Elaboration of a practical assignment about a mechanical system using advanced CAD tools.
Practical exercise nr. 2.	Elaboration of a practical assignment related to the manufacturing engineering by machining of mechanical parts, using advanced CAM tools.
Practical exercise nr. 3.	Elaboration of a practical assignment involving the simulation of a mechanical system using advanced CAE tools.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	8	18	26
Autonomous problem solving	4	19	23
Practices through ICT	9	14	23
Objective questions exam	1	0	1
Presentation	1	0	1
Systematic observation	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

Lecturing	Exhibition by the professor of the contents on the matter that is object of study, its theoretical bases and/or work guidelines aiming to the assignments that the student has to develop.
Autonomous problem solving	Activity in which the students develop assignments and/or exercises related with the subject. The student/to has to perform the analysis and resolution of the problems and/or exercises by himself in an autonomous way.
Practices through ICT	Activities to apply the gained knowledge in a certain context and to acquire basic and procedimental skills related to the matter by using ITC tools.

Personalized assistance

Methodologies	Description
Autonomous problem solving	Activity in which problems and/or exercises related with the subject are formulated. The student has to perform the analysis and resolution of the problems and/or exercises by himself in an autonomous way. For all the teaching modalities contemplated in the Contingency Plan, the tutorial sessions of could be carried out through telematic means -email, videoconference, FAITIC forums, etc.- under the modality of prior concertation of virtual place, date and hour.

Assessment

	Description	Qualification	Training and Learning Results			
Objective questions exam	Tests composed of objective questions. Mid-term and final assessment.	40	A1	B1	C23	D2
Presentation	Presentations. Assignments. Projects. Report of Laboratory activities.	40	A2 A4	B1	C24	D1
Systematic observation	Systematic observation. Complementary activities of continuous assessment.	20	A4	B3 B7	C24	D1 D2

Other comments on the Evaluation

Students who do not pass the subject in continuous training at the first opportunity of each academic year, in which the distribution of evaluation weights is as established above, will have the possibility of having an exam of objective questions, worth 100% of the final mark, in successive calls that are not the first opportunity of each academic year.

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

Fernández, Mario, **INDUSTRIA 4.0: Tecnologías y Gestión en la Transformación Digital de la Industria**, 979-8616069115, 1ª, Editor independiente, 2020

Garijo Gómez, Egberto, **Diseño y Fabricación con CATIA V5: Módulos CAM, Mecanización por arranque de viruta**, 978-8490113691, 1ª, Vision Libros, 2015

Stark, John, **Product Lifecycle Management (Volume 2): The Devil is in the Details**, 978-3319244365, 3ª, Springer International Publishing, 2016

Tickoo, Sham, **CATIA V5-6R2015 for Engineers and Designers**, 978-1936646135, 1ª, Amazon Media EU S.à r.l., 2016

Ulrich, Karl; Eppinger, Steven; Yang, María C., **Product Design and Development**, 978-1260566437, 7ª, McGraw-Hill Education, 2019

Complementary Bibliography

DASSAULT SYSTÈMES, **3DS ACADEMY**, <https://academy.3ds.com/en>, 2020, DASSAULT SYSTÈMES, 2020

Pereira, Alejandro, **Fundamentos de DELMIA: Caso práctico de simulación de celda robotizada**, -----, 2019, El Autor, 2019

Rodal Montero, Enrique, **Industria 4.0: Conceptos, tecnologías habilitadoras y retos**, 978-8436842142, 1ª, Ediciones Pirámide, 2020

Stark, John, **PLM Vision and Strategy in the Industry 4.0 World: Product Lifecycle Management in 2021**, B07FTXCSB2, 1ª, Amazon.com Services LLC, 2018

Tickoo, Sham, **SOLIDWORKS 2019 for Designers**, 978-1640570511, 17ª, CAD/CIM Technologies, 2018

Tran, Paul, **SOLIDWORKS 2020 Intermediate Skills**, 978-1630573119, 1ª, SDC Publications, 2019

Tutorial Books, **CATIA V5-6R2015 Basics Part II: Part Modeling**, B014T7CFBQ, 1ª, Tutorial Books, 2015

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 paid 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.
