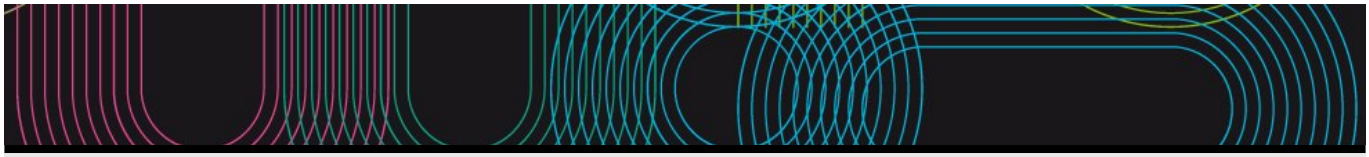

IDENTIFYING DATA				
Manufacturing engineering and dimensional quality				
Subject	Manufacturing engineering and dimensional quality			
Code	P52G381V01407			
Study programme	(*)Grao en Enxeñaría Mecánica			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	4th	2nd
Teaching language	Spanish			
Department				
Coordinator	Arce Fariña, María Elena			
Lecturers	Arce Fariña, María Elena Febrero Garrido, Lara			
E-mail	elena.arce@cud.uvigo.es			
Web	http://faitic.uvigo.es			
General description	The main objective of Manufacturing Engineering and Dimensional Quality is to complement the knowledge acquired in the subject "Fundamentals of Systems and Manufacturing Technologies" on manufacturing processes. The student will acquire skills to identify and plan the different stages of the production process from the product design specifications, selecting the different phases, machines, equipment, tools, and verification techniques more convenient. In addition, the knowledge of the student in the development of simple computer numerical control computer-aided design and manufacturing techniques programs will be strengthened.			

Competencies	
Code	
B3	Knowledge in basic and technological subjects that will enable students to learn new methods and theories, and provide them the versatility to adapt to new situations.
B8	Ability to apply the principles and methods of quality.
C26	Applied knowledge of systems and manufacturing processes, metrology and quality control.
D2	Problems resolution.
D8	Decision making.
D9	Apply knowledge.
D10	Self learning and work.
D17	Working as a team.
D20	Ability to communicate with people not expert in the field.

Learning outcomes		
Expected results from this subject	Training and Learning Results	
To know the technological base and basic aspects of manufacturing processes.	B3 B8	D2 D8 D9 D10 D17 D20
To understand basic aspects of manufacturing systems.	B3 B8	D2 D8 D9 D10 D20

To acquire skills to select manufacturing processes and to plan manufacturing.	B3 B8	C26	D2 D8 D9 D10 D20
To develop skills to manufacture groups and elements in CAD-CAM environments.	B3	C26	D8 D9 D10
Application of CAQ technologies	B3	C26	D2 D8 D9 D10 D17 D20
ENAEE learning outcome: KNOWLEDGE and UNDERSTANDING LO1.2.- Knowledge and understanding of the mathematics and other basic sciences underlying their engineering specialisation, at a level necessary to achieve the other programme outcomes. Advanced (3).	B3	C26	
ENAEE learning outcome: ENGINEERING ANALYSIS LO2.1.- Ability to analyse complex engineering products, processes and systems in their field of study; to select and apply relevant methods from established analytical, computational and experimental methods; to correctly interpret the outcomes of such analyses. Intermediate (2).		C26	D2 D8 D9
ENAEE learning outcome: ENGINEERING DESIGN LO3.1.- Ability to develop and design complex products (devices, artefacts, etc.), processes and systems in their field of study to meet established requirements, that can include an awareness of non-technical (societal, health and safety, environmental, economic and industrial) considerations; to select and apply relevant design methodologies. Intermediate (2).	B8	C26	D2 D9
ENAEE learning outcome: ENGINEERING DESIGN LO3.2.- Ability to design using some awareness of the forefront of their engineering specialisation. Advanced (3).		C26	D9
ENAEE learning outcome: ENGINEERING PRACTICE LO5.3.- Understanding of applicable materials, equipment and tools, engineering technologies and processes, and of their limitations in their field of study. Intermediate (2).			D8 D9
ENAEE learning outcome: ENGINEERING PRACTICE LO5.4.- Ability to apply norms of engineering practice in their field of study. Basic (1).			D9
ENAEE learning outcome: LIFELONG LEARNING LO8.1.- Ability to recognise the need for and to engage in independent life-long learning. Basic (1).			D8

Contents	
Topic	
THEORY	
1.- Introduction	Topic 1. Introduction to industrial production.
2.- Engineering of Manufacture	Topic 2. Modelling and simulation of mechanical manufacturing processes. Topic 3. Analysis, implementation and optimization of forming processes. Topic 4. Lines and systems of mechanical manufacturing and their simulation: CAM systems. Transfer" systems. Production lines. Systems and cells of flexible manufacturing. Integrated manufacturing. Topic 5. Planning of the manufacturing processes: Design plan analysis. Selection of the processes and determination of the manufacturing sequence. Process sheet definition. Technological management of manufacturing.

3.- Systems of quality	Topic 6. The field of dimensional metrology Precision in industry. Measurement errors. Measurement chains. Topic 7. Calibration. The metrological organization. Uncertainty in measurement. Traceability and dissemination. Calibration plan. Topic 8. Systems, machines, inspection and verification equipment in mechanical manufacturing. Topic 9. Modelling and measurement of surface quality. Topic 10. Statistical process control. Control charts by variables. Control charts by attributes. Machine and process capacity. Topic 11. Quality of the measures in the industry. Evaluation of the quality of the measurements. Tools and techniques to evaluate the dimensional quality and its costs. Topic 12. Techniques and metrological systems. Legal and industrial metrology.
PRACTICE	
Practical sessions 1 and 2: Computer Aided Manufacturing	These practical sessions are aimed at the computer-aided design of Personal Protective Equipment (PPE) in accordance with Royal Decree 773/1997 (Directive 89/656/EEC) on the use of PPE and Regulation (EU) 2016/425 on its marketing. The PPE designed will be printed in 3D, and the students must select the material, the manufacturing characteristics, as well as carry out the rapid prototyping of these parts. With these practices, the aim is to apply theoretical knowledge to the machining of parts using Autodesk Inventor software.
Practical sessions 3, 4 and 5: Quality in industry	Tools and techniques will be studied to evaluate the dimensional quality and its costs. In addition, the importance and principles of continuous improvement will be presented through the analysis of real cases. All this will allow to train students for the maintenance and improvement of the basic stability in the organizations.
Practical Sessions 6 and 7: Statistical Process Control	Practical cases of analysis of productive systems through control charts by variables, control charts by attributes and the study of machine and process capacities will be carried out.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	26	36	62
Practices through ICT	14	0	14
Mentored work	0	14	14
Seminars	7	5	12
Seminars	15	8	23
Essay questions exam	2	0	2
Report of practices, practicum and external practices	0	13	13
Essay questions exam	9	0	9
Problem and/or exercise solving	0	1	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	In these sessions, the basic theoretical contents of the subject will be explained in detail, exposing explanatory examples to deepen the understanding of the subject. The slides and the blackboard will be used in combination. As far as possible, a copy of the slides will be provided to the students prior to the lesson, focusing the effort of the lecturer and students on the exposure and understanding of the knowledge. In any case, paper reproductions of slides should never be considered as substitutes for texts or notes, but as complementary material.
Practices through ICT	In order to contribute to the acquisition of generic competences, the evaluation of practice sessions is proposed either with the preparation of individual reports or with reports by group. When the elaboration of the report is collective and in order to ensure that the interdependence is positive, all the members of the group must have worked and contributed to the final product and must dominate, minimally, all aspects of the practical session.

Mentored work	The didactic method to follow in the delivery of practical classes is that the lecturer mentored the work carried out by the groups in which the students are divided. The practices are aimed at strengthening the theoretical concepts addressed in the lecturing sessions and facilitate the assimilation of the concepts with regard to their application in the design of structures and elements of machines.
Seminars	Given that the tutorial action is addressed as a group support action to the student's learning process by solving problems and exercises, the sessions will be carried out preferably in seminars and in the format of small meeting groups.
Seminars	Intensive course of 15 hours for those students who did not pass the subject in the first call, prior to the examination of the second call. Tutorial groups with the lecturer.

Personalized assistance

Methodologies	Description
Seminars	In the seminars lecturers propose the resolution of problems and study cases related with the lecturing sessions. The faculty will personally attend to the doubts and queries of the students, both in person (the timetable will be published on the centre's website) and through telematic means (e-mail, videoconference, FAITIC forums, etc.) by appointment.
Mentored work	During the practical sessions of the subject different mentored works will be implemented in groups of students. The lecturer will answer personally questions and queries of the students.

Assessment

	Description	Qualification	Training and Learning Results		
Essay questions exam	PI. Two mandatory intermediate tests will be held during the course (PI1 and PI2). PI1 for subjects T1-T5 and PI2 for subjects T6-T9. Each test has a weight of 15% on the final grade.	30	B3 B8	C26	D2 D9 D10 D20
Report of practices, practicum and external practices	MP Delivery of reports to evaluate the knowledge acquired in the practical sessions and mentored works (P1-P7)	20	B3	C26	D2 D8 D9 D10 D17 D20
Essay questions exam	PF Writing final test final to evaluate the global knowledge of the subject (official date of evaluation)	40	B3 B8	C26	D2 D8 D9 D10 D20
Problem and/or exercise solving	CT. Questionnaires and tests will be carried out through online teaching platforms corresponding to the subject matter taught.	10	B3 B8	C26	D2 D8 D9 D10 D17 D20

Other comments on the Evaluation

The final evaluation of the student will be the sum of the score awarded to each of the parts mentioned above and taking into account the requirement of a minimum of 4 in the final exam.

Being, therefore, the continuous evaluation grade:

- In case of meeting the requirements,

$NEC = 0.40 \cdot PF + 0.15 \cdot PI1 + 0.15 \cdot PI2 + 0.20 \cdot MP + 0.1 \cdot CT$

- In case of not meeting the requirements, the maximum grade obtained will be a 4.

The student must attend to the ordinary examination of all the contents of the subject, which will be 100% of the grade, in the following cases:

- The non-completion or delivery of any of the previous points.

- Get a grade below 4 points out of 10 in the final exam.

- Not having passed the continuous assessment with a 5.

In any case, the student who has passed the continuous assessment, will have the possibility of attending the ordinary exam to raise the grade.

ETHICAL COMMITMENT: Students are expected to have adequate ethical behavior. If unethical behavior is detected (cheating, plagiarism, use of unauthorized electronic devices or others), the student will be penalized with the impossibility of passing the subject by the continuous assessment modality (in which he/she will obtain a grade of 0.0). If this type of behavior is detected in ordinary or extraordinary exam, the student will obtain in the call a score in 0.0.

Sources of information

Basic Bibliography

Kalpakjian, Schmid, **Manufactura, ingeniería y tecnología**,
Pereira Domínguez, Alejandro; Diéguez Quintas, José L., **Tecnología y sistemas de fabricación**,
Bootrhoyd, Geoffrey, **Product design for manufacture and assembly**,
Bootrhoyd, Geoffrey, **Assembly Automation and Product Design**,
Todd, R.H.; Allen, D.K.; Alting, L, **Fundamental principles of manufacturing processes**,
Alting, L., **Procesos para ingeniería de manufactura**,

Complementary Bibliography

Faura, F, **Prácticas de tecnología mecánica**,
Groover, M. P., **Fundamentos de manufactura moderna: materiales, procesos y sistemas**,
Diéguez, J.L.; Pereira, A.; Ares, J.E., **Fundamentos de fabricación mecánica**,
De Garmo, E.P.; Black, J.T.; Kohser, R.A., **Materiales y procesos de fabricación**,
Lasheras J.M., **Tecnología mecánica y metrotecnia**,

Recommendations

Subjects that it is recommended to have taken before

Graphic expression: Graphic expression/P52G381V01101
Resistance of materials/P52G381V01204
Fundamentals of manufacturing systems and technologies/P52G381V01402

Other comments

The student who accesses the fourth year of the mechanics engineering bachelor degree, and in particular to this subject, should have a minimum capacity to:
- Written and oral comprehension.
- Abstraction, basic calculation and synthesis of information.
- Use dimensional measurement and verification instruments in the laboratory/workshop.
- Use statistics in the Quality control.
- Dimension and define tolerances adequately and precisely to mechanical elements.
- Represent using 3D CAD parts and basic sets.
- Use and know the manual machine tools and their basic operations.
- Develop basic programs of numerical control in lathe and milling machine, and select the tools.
- Plan processes of machining, deformation and welding to produce parts and/or basic sets.
- Apply the theory of Elasticity and know how to represent tension states through Mohr circles.

If the student accesses without these competences, he/she will not be able to have an optimal learning process and will need a longer time to acquire and update their skills so that the final training is as expected.

Contingency plan

Description

=== PLANNED EMERGENCY MEASURES ===

In view of the uncertain and unpredictable evolution of the health alert caused by the COVID-19, the University of Vigo has established an extraordinary planning that will be activated at the time when the administrations and the institution itself determine it in accordance with safety, health and responsibility criteria, and guaranteeing teaching in a non-presential or partially presential scenario. These measures, already planned, guarantee the development of teaching in a more agile and effective way when they are known beforehand (or well in advance) by students and teachers through the standardized and institutionalized tool of syllabus.

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Below are those aspects that will be modified in the guide in the event that some action is determined to be derived from safety criteria.

Sections of the syllabus to be modified:

 Contents of the matter.

- Computer Aided Manufacturing Practices 1 and 2 will not include 3D design printing, replacing this part with simulation of the manufacturing process in an Autodesk Inventor CAM environment.

 Teaching methodology

A new teaching methodology is added:

- Synchronous online meeting (theory or practical session):

It is given through a web videoconference platform. Each virtual classroom contains various display panels and components, whose design can be customized to best suit the needs of the lecture. In the virtual classroom, lectures (and those authorized participants) can share their computer screen or files, use a whiteboard, chat, stream audio and video, or participate in interactive online activities (surveys, questions, etc.).

 Learning Assessment

- The evaluation tests will be carried out by combining the FAITIC-Moodle online teaching platform and the Remote Campus of the University of Vigo.