



1. General information

Course: AEROSPACE MANUFACTURING AND MAINTENANCE**Code:** 56729**Type:** CORE COURSE**ECTS credits:** 6**Degree:** 403 - UNDERGRADUATE DEGREE PROGRAMME IN AEROSPACE ENGINEERING**Academic year:** 2023-24**Center:** 303 - E.DE INGENIERÍA INDUSTRIAL Y AEROESPACIAL DE TOLEDO**Group(s):** 40**Year:** 3**Duration:** C2**Main language:** Spanish**Second language:****Use of additional languages:****English Friendly:** N**Web site:** campusvirtual.uclm.es**Bilingual:** N**Lecturer:** RUBÉN DAPICA TEJADA - Group(s): 40

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2. Pre-Requisites

The student must previously know basic concepts of Statistics, Applied Mechanics, Machine Theory, Business Management, Materials Science, Resistance of materials.

3. Justification in the curriculum, relation to other subjects and to the profession

One of the pillars of the formation of the aeronautical engineer must be the knowledge of the product design specifications, the production technologies and their fundamentals, the automated manufacturing systems, and the quality control of the process and the product. This subject provides the student with this knowledge that is necessary for the performance of the profession of aeronautical engineer.

The production of goods and services is the ultimate goal of any industry. The aerospace equipment and materials engineer must have a clear vision of both its manufacture and the effect that such equipment and materials can have on aerospace production.

"Aerospace Manufacturing and Maintenance", in addition to the basic skills that it provides to students, is focused on providing the basis for understanding the manufacturing processes themselves.

4. Degree competences achieved in this course

Course competences

Code	Description
CA01	Ability to carry out bibliographic searches, use databases and other sources of information for its application in tasks related to Technical Aeronautical Engineering.
CA02	Ability to efficiently design experimentation procedures, interpret the data obtained and specify valid conclusions in the field of Aeronautical Technical Engineering.
CA03	Ability to autonomously select and carry out the appropriate experimental procedure, operating the equipment correctly, in the analysis of phenomena within the scope of Engineering.
CA04	Ability to select advanced tools and techniques and their application in the field of Aeronautical Technical Engineering.
CA05	Knowledge of the methods, techniques and tools as well as their limitations in the application for the resolution of problems typical of Aeronautical Technical Engineering.
CA06	Ability to identify and assess the effects of any solution in the field of Aeronautical Technical Engineering within a broad and global context and the ability to interrelate the solution to an engineering problem with other variables beyond the technological field, which must be considered.
CA07	Knowledge, understanding and ability to apply business and project management practices, as well as their limitations in the exercise of the profession of Technical Aeronautical Engineer.
CB02	Apply their knowledge to their job or vocation in a professional manner and show that they have the competences to construct and justify arguments and solve problems within their subject area.
CB03	Be able to gather and process relevant information (usually within their subject area) to give opinions, including reflections on relevant social, scientific or ethical issues.
CB04	Transmit information, ideas, problems and solutions for both specialist and non-specialist audiences.
CB05	Have developed the necessary learning abilities to carry on studying autonomously
CE11	Knowledge of the technological benefits, the optimization techniques of the materials and the modification of their properties by means of treatments.
CE12	Knowledge of manufacturing processes.
	Applied knowledge of: materials science and technology; mechanics and thermodynamics; fluid mechanics; aerodynamics and

CE19	mechanics of flight; air traffic and navigation systems; aerospace technology; structure theory; air Transport; economy and production; Projects; environmental impact.
CE20	Knowledge applied to Engineering of: The fundamentals of sustainability, maintainability and operability of space systems.
CE23	Knowledge applied to Engineering of: Technological performance, optimization techniques for materials used in the aerospace sector and treatment processes to modify their mechanical properties.
CE25	Knowledge applied to Engineering of: The methods of calculation and development of defense materials and systems; the management of experimental techniques, equipment and measuring instruments typical of the discipline; the numerical simulation of the most significant physical-mathematical processes; inspection, quality control and fault detection techniques; the most appropriate repair methods and techniques.
CG02	Planning, drafting, direction and management of projects, calculation and manufacturing in the field of aeronautical engineering that have as their object, in accordance with the knowledge acquired as established in section 5 of order CIN/308/2009, aerospace vehicles , aerospace propulsion systems, aerospace materials, airport infrastructures, air navigation infrastructures and any space, traffic and air transport management system.
CG03	Installation, operation and maintenance in the field of aeronautical engineering that have as their object, in accordance with the knowledge acquired as established in section 5 of order CIN/308/2009, aerospace vehicles, aerospace propulsion systems, materials aerospace, airport infrastructure, air navigation infrastructure and any space, traffic and air transport management system.
CG04	Verification and Certification in the field of aeronautical engineering that have as their object, in accordance with the knowledge acquired as established in section 5 of order CIN/308/2009, aerospace vehicles, aerospace propulsion systems, aerospace materials , airport infrastructures, air navigation infrastructures and any space, traffic and air transport management system.
CG05	Ability to carry out activities of projection, technical direction, expert opinion, report writing, opinions, and technical advice on tasks related to Aeronautical Technical Engineering, exercise of functions and genuine aerospace technical positions.
CG07	Ability to analyze and assess the social and environmental impact of technical solutions.
CG08	Knowledge, understanding and ability to apply the necessary legislation in the exercise of the profession of Aeronautical Technical Engineer.
CT04	Knowledge of ethical commitment and professional ethics.

5. Objectives or Learning Outcomes

Course learning outcomes

Description

6. Units / Contents

Unit 1: Manufacturing processes

Unit 1.1 Casting and molding

Unit 1.2 Plastic deformation

Unit 1.3 Joining processes

Unit 1.4 Manufacturing by removal of material

Unit 1.5 Manufacturing processes of polymer materials

Unit 1.6 Manufacturing processes of composite materials

Unit 1.7 Additive manufacturing processes

Unit 2: Production management and control

Unit 2.1 Introduction to production systems

Unit 2.2 Computer aided manufacturing systems (CAM). Computer-aided numerical control (CNC) programming

Unit 2.3 Quality control in manufacturing. Dimensional metrology and surface finish. Non-destructive testing (NDT)

Unit 3: Maintenance

Unit 3.1 Reliability engineering. Corrective and predictive maintenance.

Unit 3.2 Bases of aeronautical maintenance.

Unit 3.3 Regulations and Certification.

7. Activities, Units/Modules and Methodology

Training Activity	Methodology	Related Competences (only degrees before RD 822/2021)	ECTS	Hours	As	Com	Description
Class Attendance (theory) [ON-SITE]	Lectures	CA02 CA03 CA04 CA05 CA06 CA07 CB02 CB03 CB05 CE11 CE12 CE19 CE20 CE23 CE25 CG02 CG03 CG04 CG05 CG07 CG08 CT04	1.2	30	N		Development in the classroom of the theoretical contents, using the method of the participatory lecture.
Problem solving and/or case studies [ON-SITE]	Problem solving and exercises	CA02 CA03 CA04 CA05 CA06 CA07 CB02 CB03 CB04 CB05 CE11 CE12 CE19 CE20 CE23 CE25 CG02 CG03 CG04 CG05 CG07 CG08 CT04	0.24	6	N		Resolution of exercises and problems in the classroom in a participatory manner.
Laboratory practice or sessions [ON-SITE]	Practical or hands-on activities	CA02 CA03 CA04 CA05 CA06 CA07 CB02 CB03 CB04 CB05 CE11 CE12 CE19 CE20 CE23 CE25 CG02 CG03 CG04 CG05 CG07 CG08 CT04	0.56	14	Y	Y	Laboratory practices where the student puts into practice the knowledge acquired in the theoretical classes through experimentation. Questions and observations during the practices, will be incorporated into the note of the practice report.
		CA02 CA03 CA04 CA05					

Group tutoring sessions [ON-SITE]	Guided or supervised work	CA06 CA07 CB02 CB03 CB05 CE11 CE12 CE19 CE20 CE23 CE25 CG02 CG03 CG04 CG05 CG07 CG08 CT04	0.24	6	N	-	Tutorials in which students can consult all doubts regarding the subject.
Writing of reports or projects [OFF- SITE]	Cooperative / Collaborative Learning	CA01 CA02 CA03 CA04 CA05 CA06 CA07 CB02 CB03 CB04 CB05 CE11 CE12 CE19 CE20 CE23 CE25 CG02 CG03 CG04 CG05 CG07 CG08 CT04	1.2	30	Y	Y	Preparation of reports or work.
Study and Exam Preparation [OFF- SITE]	Self-study	CA01 CA02 CA03 CA04 CA05 CA06 CA07 CB02 CB03 CB04 CB05 CE11 CE12 CE19 CE20 CE23 CE25 CG02 CG03 CG04 CG05 CG07 CG08 CT04	1.92	48	N	-	Autonomous personal study of theory and problems where the student exercises the knowledge learned in the face-to-face classes in the classroom.
Final test [ON-SITE]	Assessment tests	CA02 CA03 CA04 CA05 CA06 CA07 CB02 CB03 CB04 CB05 CE11 CE12 CE19 CE20 CE23 CE25 CG02 CG03 CG04 CG05 CG07 CG08 CT04	0.16	4	Y	Y	Written test (final exam).
Other off-site activity [OFF-SITE]	Problem solving and exercises	CA01 CA02 CA03 CA04 CA05 CA06 CA07 CB02 CB03 CB04 CB05 CE11 CE12 CE19 CE20 CE23 CE25 CG02 CG03 CG04 CG05 CG07 CG08 CT04	0.48	12	Y	N	Supplement for Problem Solving and/or cases that is carried out remotely and involves autonomous study by the student.
Total:			6	150			
Total credits of in-class work: 2.4			Total class time hours: 60				
Total credits of out of class work: 3.6			Total hours of out of class work: 90				

As: Assessable training activity

Com: Training activity of compulsory overcoming (It will be essential to overcome both continuous and non-continuous assessment).

8. Evaluation criteria and Grading System

Evaluation System	Continuous assessment	Non-continuous evaluation*	Description
Final test	70.00%	70.00%	Test with theoretical and practical aspects of the subject. The minimum grade for this part to be compensable will be 4 points (out of 10).
Practicum and practical activities reports assessment	20.00%	20.00%	Experimental practices. Attendance to practices is considered mandatory for all students who follow the subject in continuous assessment. The use of the development of the experimental practices, as well as the questions and observations during the practices, will be incorporated into the note of the practice report. The minimum grade for this part to be compensable will be 4 points (out of 10).
Assessment of problem solving and/or case studies	10.00%	10.00%	Practical content test in which problems or cases related to the subject will be raised.
Total:	100.00%	100.00%	

According to art. 4 of the UCLM Student Evaluation Regulations, it must be provided to students who cannot regularly attend face-to-face training activities the passing of the subject, having the right (art. 12.2) to be globally graded, in 2 annual calls per subject, an ordinary and an extraordinary one (evaluating 100% of the competences).

Evaluation criteria for the final exam:

Continuous assessment:

The final grade in continuous assessment will be:

70% final test + 40% final test + 20% Experimental Practices + 10% Resolution of problems or cases.

To pass the subject it is necessary to get a 5 out of 10 in the final grade, after taking the average of all the activities.

If in an evaluable test the minimum mark to compensate has not been reached, the final mark will not be higher than 4 points (out of 10).

Non-continuous evaluation:

100% of the mark will correspond to a final exam, which includes all the contents seen during the course, including problem solving or cases and practices, maintaining the percentages of each part indicated in the evaluation system.

To pass the subject it is necessary to get a grade equal to or greater than 5 points out of 10 after performing the weighted average of the parts and meeting the minimum grade criteria indicated in the ordinary call.

In the event that the grade of the final test or of the laboratory practices is < 4, the final grade of the subject may not be higher than 4.

Specifications for the resit/retake exam:

The same as in the ordinary evaluation.

Specifications for the second resit / retake exam:

The same as the ordinary call for non-continuous evaluation.

9. Assignments, course calendar and important dates

Not related to the syllabus/contents

Hours	hours
Class Attendance (theory) [PRESENCIAL][Lectures]	30
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	6
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	14
Group tutoring sessions [PRESENCIAL][Guided or supervised work]	6
Writing of reports or projects [AUTÓNOMA][Cooperative / Collaborative Learning]	30
Study and Exam Preparation [AUTÓNOMA][Self-study]	48
Final test [PRESENCIAL][Assessment tests]	4
Other off-site activity [AUTÓNOMA][Problem solving and exercises]	12
General comments about the planning: In the implementation phase of the subject, in order to optimize the information received by the student, a particularly careful coordination work will be carried out with the rest of the subjects. This implies possible modifications in the order and depth with which the topics are taught. In general, approximately 50% will be dedicated to Manufacturing and 50% to Maintenance.	
Global activity	
Activities	hours
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	14
Group tutoring sessions [PRESENCIAL][Guided or supervised work]	6
Writing of reports or projects [AUTÓNOMA][Cooperative / Collaborative Learning]	30
Study and Exam Preparation [AUTÓNOMA][Self-study]	48
Class Attendance (theory) [PRESENCIAL][Lectures]	30
Final test [PRESENCIAL][Assessment tests]	4
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	6
Other off-site activity [AUTÓNOMA][Problem solving and exercises]	12
Total horas: 150	

10. Bibliography and Sources						
Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
S. Kalpakjian, S.R. Schmid	Manufactura, Ingeniería y Tecnología	Pearson Education Inc., Prentice Hall		0-13-148965-8	2008	
M. P. Groover,	Fundamentos de manufactura moderna: materiales, procesos y sistemas	Thomson		84-9732-258-4	2005	
Saha, Pradip K.	Aerospace manufacturing processes	CRC Press		9780367736927	2016	
Breneman, J. E., Sahay, C., & Lewis, E. E.	Introduction to reliability engineering. 3rd edition	John Wiley & Sons		9781119640561	2022	
Kumar, U. D., Crocker, J., Knezevic, J., & El-Haram, M.	Reliability, maintenance and logistic support:-A life cycle approach	Springer Science & Business Media		9781461371069	2000	