

**1. General information****Course:** METROLOGY AND QUALITY IN MANUFACTURING PROCESSES**Type:** ELECTIVE**Degree:** 420 - UNDERGRADUATE DEGREE PROGRAMME IN MECHANICAL ENGINEERING**Center:** 605 - SCHOOL OF INDUSTRIAL ENGINEERS. AB**Year:** 4**Main language:** English**Use of additional languages:****Web site:****Code:** 56335**ECTS credits:** 6**Academic year:** 2023-24**Group(s):** 11**Duration:** First semester**Second language:** Spanish**English Friendly:** N**Bilingual:** Y**Lecturer:** MARIA CARMEN MANJABACAS TENDERO - Group(s): 11

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2. Pre-Requisites

Although no requirements are necessary, it is strongly recommended that the student has previously studied the courses Manufacturing Processes and Industrial Organization and Manufacturing Technology.

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

This course is close to the courses "Procesos de Fabricación y Organización Industrial" y "Tecnología de Fabricación". Thus the contents are a deeper treatment of the quality techniques of the dimensional control for manufacturing products in the mechanical industry. Therefore, students acquire professional competences that are directly connected to the mechanical manufacturing processes..

4. Degree competences achieved in this course**Course competences**

Code	Description
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.
CB05	Have developed the necessary learning abilities to carry on studying autonomously
CEO03	Capacity to design and apply measurement procedures for manufacturing as part of the production process.
CEO11	Acquisition of specific laboratory-related dimensional metrology skills.
CEO12	Capacity to design and apply integrated quality systems in product manufacturing processes.
CG03	Knowledge of basic and technological subjects to facilitate learning of new methods and theories, and provide versatility to adapt to new situations.
CG04	Ability to solve problems with initiative, decision-making, creativity, critical reasoning and to communicate and transmit knowledge, skills and abilities in the field of industrial engineering.
CG06	Ability to handle specifications, regulations and mandatory standards.
CG08	Ability to apply quality principles and methods.

5. Objectives or Learning Outcomes**Course learning outcomes****Description**

Knowledge and application of quality systems in the field of mechanical manufacturing.

Acquisition of laboratory skills and competences in materials science, mechanical testing, metrology and manufacturing.

Additional outcomes

Practice of English language in the course arena

6. Units / Contents

Unit 1: Analysis of the contributions to the uncertainty in Measurement

Unit 2: Calibration of instruments to measure lengths and angles; measurement and verification of lengths and angles.

Unit 3: Elements that take part in a calibration planning

Unit 4: Analysis and treatment of tolerances.

Unit 5: Measurement and control of mechanical elements; threads and gears.

Unit 6: Measurement of shapes.

Unit 7: Measurement of surface finishing. Roughness.

Unit 8: Measurement of non dimensional magnitudes.

Unit 9: Sampling plans and quality control.

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]	Combination of methods	CEO03 CEO12 CG06 CG08	0.88	22	Y	N	
Laboratory practice or sessions [ON-SITE]	Combination of methods	CB03 CB05 CEO03 CEO11 CEO12 CG04 CG06 CG08	0.6	15	Y	N	
Formative Assessment [ON-SITE]	Assessment tests	CB03 CB05 CEO11 CEO12 CG04 CG06 CG08	0.24	6	Y	N	Include the final exams in case this was according to the established evaluation criteria.
Self-study [OFF-SITE]	Self-study	CB03 CB05 CEO03 CEO11 CEO12 CG03 CG04 CG06 CG08	3.6	90	Y	N	
Project or Topic Presentations [ON-SITE]	Combination of methods	CB03 CB05 CEO03 CEO11 CEO12 CG03 CG04 CG06 CG08	0.52	13	Y	N	
Individual tutoring sessions [ON-SITE]	Combination of methods	CB03 CB05 CEO03 CEO11 CG03 CG04 CG06 CG08	0.16	4	N		Individual attendance of students related to the different activities carried out in the course.
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
Oral presentations assessment	15.00%	15.00%	
Laboratory sessions	25.00%	25.00%	
Assessment of active participation	10.00%	0.00%	
Mid-term tests	50.00%	0.00%	
Final test	0.00%	60.00%	
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 student must take the exam in the ordinary call on the contents not passed or compensated in partial exams. In order to compensate a partial test, the student must obtain a minimum mark of 3.5 out of 10. In particular, in the ordinary call, the student must take the exam on the contents not previously assessed in partial exams. The overall mark of the ordinary test, together with those of the mid-term exams passed or compensated, if applicable, will correspond to 50% of the evaluation. Note: in case the student does not get the minimum mark of 3.5 points required to pass the subject in the exam taken in the ordinary call, he/she will be graded with the mark obtained in that exam.

Although it is obvious, we remind the student that in order to pass the course it must be obtained at least 5 points in the weighted grade of the assessed activities.

Non-continuous evaluation:

In case the student is not assessed continuously, he/she will take a final test with the theoretical-practical contents of the subject with a weighting of 60%. A specific part will be included with questions representative of the students oral presentations, with a weighting of 15%. The minimum grade of the exam of theoretical and practical contents of the course must be 3.5 points out of 10 in order to pass the course. The student must ask the professor to take a practical exam worth 25% of the course. The student must request the practical exam prior to the exam established in the ordinary call. The exam will consist of doing one or more practicals carried out during the course; the a date and time of this exam will be arranged with the student.

Although it is obvious, we remind the student that in order to pass the course it must be obtained at least 5 points in the weighted grade of the assessed activities.

Specifications for the resit/retake exam:

Students evaluated by continuous system must do an exam about the course contents (50%) and it is necessary to obtain 3.5 out of 10 to pass the course. If the student does not reach the minimum score pointed out before in the exam, the global score will be the one obtained in it. Laboratory activities, oral presentation of topics and the participation in classes activities, will be taken into account. If the student needs to recover any of these parts for not having been passed, a specific exam for the corresponding parts should be done. Particularly, participation in classes will be recovered weighting 60% the exam of the course contents.

Students that were evaluated by non-continuous system, will be under the same considerations than those applied in the ordinary call.

Specifications for the second resit / retake exam:

The specifications for the resit/retake exam are applicable.

9. Assignments, course calendar and important dates	
Not related to the syllabus/contents	
Hours	hours
Class Attendance (theory) [PRESENCIAL][Combination of methods]	22

Laboratory practice or sessions [PRESENCIAL][Combination of methods]	15
Formative Assessment [PRESENCIAL][Assessment tests]	6
Self-study [AUTÓNOMA][Self-study]	90
Project or Topic Presentations [PRESENCIAL][Combination of methods]	13
Individual tutoring sessions [PRESENCIAL][Combination of methods]	4
General comments about the planning: Two partial exams may be done depending on the number of students: the first one could be foreseen in the 8th week and the second one in the last week of the semester. Students presentations (oral works) could be carried out every week from the 5th one but it will be studied at the beginning of the semester according to the ratio. The established planning may be subjected to changes according to the dynamic of the course and to the teacher criterion.	
Global activity	
Activities	hours
Individual tutoring sessions [PRESENCIAL][Combination of methods]	4
Formative Assessment [PRESENCIAL][Assessment tests]	6
Self-study [AUTÓNOMA][Self-study]	90
Laboratory practice or sessions [PRESENCIAL][Combination of methods]	15
Class Attendance (theory) [PRESENCIAL][Combination of methods]	22
Project or Topic Presentations [PRESENCIAL][Combination of methods]	13
Total horas: 150	

10. Bibliography and Sources						
Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
C.L. Dotson	Fundamentals of Dimensional Metrology 6th ed.	Cengage Learning	USA	978-1-1336-0089-3	2016	
G.M.S. Silva	Basic Metrology for ISO 9000 Certification	Newes Books		978-0-7506-5165-3	2002	
G.T. Smith	Industrial Metrology, Surfaces and Roundness	Springer			2001	
N.V.Raghavendra; L. Krishnamurthy	Engineering Metrology and Measurement	Osford	India	978-0-19-8055-49-2	2013	
ISO	ISO Standards	ISO				
J.L. Bucher	The Metrology Handbook	ASQ Quality Press			2004	
M.C. Manjabacas; V. Miguel	Teoría y práctica de la metrología dimensional aplicada a la fabricación en ingeniería	Ediciones de la Universidad de Castilla-La Mancha	Cuenca	978-84-9044-539-6	2022	
Working Group 1 of the Joint Committee for Guides in Metrology (JCGM/WG 1)	https://ruidera.uclm.es/server/api/core/bitstreams/e84106a8-b24a-4042-828b-b77055899434/content Evaluation of measurement data ¿ Guide to the expression of uncertainty in measurement http://www.bipm.org/utls/common/documents/jcgm/JCGM_100_2008_E.pdf	BIPM			2008	