

**1. General information****Course:** METROLOGY AND QUALITY IN MANUFACTURING PROCESSES**Code:** 56335**Type:** ELECTIVE**ECTS credits:** 6**Degree:** 352 - UNDERGRADUATE DEGREE PROGRAMME IN MECHANICAL ENGINEERING (AB)**Academic year:** 2021-22**Center:** 605 - SCHOOL OF INDUSTRIAL ENGINEERS. AB**Group(s):** 11**Year:** 4**Duration:** First semester**Main language:** English**Second language:****Use of additional languages:****English Friendly:** N**Web site:** <https://campusvirtual.uclm.es>**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
A03	To have the capability to gather and interpret relevant data (normally within the area of study) to make judgements that include a reflection on themes of a social, scientific or ethical nature.
A05	To have developed the learning skills necessary to undertake subsequent studies with a greater degree of autonomy.
A12	Knowledge of basic materials and technologies that assist the learning of new methods and theories and enable versatility to adapt to new situations.
A13	Ability to take the initiative to solve problems, take decisions, creativity, critical reasoning and ability to communicate and transmit knowledge, skills and abilities in Mechanical Engineering.
A15	Ability to work to specifications and comply with obligatory rules and regulations.
A17	Ability to apply principles and methods of quality control.
F10	Develop specific skills in the dimensional metrology laboratory environment.
F11	Ability to design and apply integrated quality systems in the product manufacturing process.
F9	Ability to design and apply measurement processes for manufacturing as part of the production process.

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

Gain skills and abilities in the materials science laboratory, mechanical trials, metrology and manufacturing

Know and apply quality systems in the machinery manufacturing environment

Additional outcomes

Practice of English language in the course arena

Know and apply Information and Communication Technologies

Use a proper oral and written communication

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]	Lectures	A15 A17 F11 F9	0.46	11.5	Y	N	
Class Attendance (practical) [ON-SITE]	Combination of methods	A03 A05 A13 A15 A17 F10 F11 F9	0.53	13.25	Y	N	
Problem solving and/or case studies [ON-SITE]	Combination of methods	A03 A05 A13 A15 A17 F10 F11	0.38	9.5	Y	N	
Progress test [ON-SITE]	Self-study	A03 A05 A13 A15 A17 F10 F11	0.37	9.25	Y	N	Include the final exams in case this was according to the established evaluation criteria.
Study and Exam Preparation [OFF-SITE]	Self-study	A03 A05 A12 A13 A15 A17 F10 F11 F9	3.6	90	Y	N	Include as well the study for preparation of reports and their presentation (laboratory and theoretical).
Project or Topic Presentations [ON-SITE]	Combination of methods	A03 A05 A12 A13 A15 A17 F10 F11 F9	0.52	13	Y	N	
Individual tutoring sessions [ON-SITE]	Combination of methods	A03 A05 A12 A13 A15 A17 F10 F11 F9	0.14	3.5	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%	0.00%	
Laboratory sessions	25.00%	0.00%	
Assessment of active participation	10.00%	0.00%	
Final test	50.00%	100.00%	
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 score of the students must be 3.5 out of 10 in their progress tests in order to be able to pass the course and/or eliminate the corresponding part for being done in the exam of the ordinary call. In other case, students will have to do the final exam. In that exam the minimum mark should be 3.5 points to pass the global evaluation of 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 the exam.

Non-continuous evaluation:

Students must obtain a mark of 5 points throughout the next parts in the evaluation: theoretical and practical contents (60%), a specific lab exam (25%) and an oral/written exam related to the contents involved in the students' oral presentations carried out during the course (15%).

In the theoretical-practical exam the minimum mark should be 3.5 points to pass the global evaluation of 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 the exam.

Specifications for the resit/retake exam:

Students evaluated by continuous system must do an exam about the course contents (50%). 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. Nevertheless 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 the exam.

Students that were evaluated by non-continuous system in the ordinary assessment 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
Progress test [PRESENCIAL][Self-study]	9.2
Study and Exam Preparation [AUTÓNOMA][Self-study]	90
Individual tutoring sessions [PRESENCIAL][Combination of methods]	3.6
General comments about the planning: Two progress exams will be done: the first one is foreseen in the 8th week and the second one in the last week of the semester. Students' works presentations (oral) should be carried out every week from the 5th one. The established planning is subjected to changes according	

to the dynamic of the course and to the teacher criterion.

Unit 1 (de 9): Analysis of the contributions to the uncertainty in Measurement	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	5.75
Problem solving and/or case studies [PRESENCIAL][Combination of methods]	4.6
Project or Topic Presentations [PRESENCIAL][Combination of methods]	1
Unit 2 (de 9): Calibration of instruments to measure lengths and angles; measurement and verification of lengths and angles.	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	1
Class Attendance (practical) [PRESENCIAL][Combination of methods]	6
Problem solving and/or case studies [PRESENCIAL][Combination of methods]	2
Project or Topic Presentations [PRESENCIAL][Combination of methods]	2
Unit 3 (de 9): Elements that take part in a calibration planning	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	1.6
Problem solving and/or case studies [PRESENCIAL][Combination of methods]	.5
Project or Topic Presentations [PRESENCIAL][Combination of methods]	.5
Unit 4 (de 9): Analysis and treatment of tolerances.	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Problem solving and/or case studies [PRESENCIAL][Combination of methods]	1.5
Project or Topic Presentations [PRESENCIAL][Combination of methods]	.5
Unit 5 (de 9): Measurement and control of mechanical elements; threads and gears.	
Activities	Hours
Class Attendance (practical) [PRESENCIAL][Combination of methods]	4
Problem solving and/or case studies [PRESENCIAL][Combination of methods]	.5
Project or Topic Presentations [PRESENCIAL][Combination of methods]	2
Unit 6 (de 9): Measurement of shapes.	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	.25
Class Attendance (practical) [PRESENCIAL][Combination of methods]	2
Project or Topic Presentations [PRESENCIAL][Combination of methods]	2
Unit 7 (de 9): Measurement of surface finishing. Roughness.	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	1
Class Attendance (practical) [PRESENCIAL][Combination of methods]	1
Problem solving and/or case studies [PRESENCIAL][Combination of methods]	.5
Project or Topic Presentations [PRESENCIAL][Combination of methods]	1
Unit 8 (de 9): Measurement of non dimensional magnitudes.	
Activities	Hours
Project or Topic Presentations [PRESENCIAL][Combination of methods]	2
Unit 9 (de 9): Sampling plans and quality control.	
Activities	Hours
Project or Topic Presentations [PRESENCIAL][Combination of methods]	2
Global activity	
Activities	hours
Project or Topic Presentations [PRESENCIAL][Combination of methods]	13
Individual tutoring sessions [PRESENCIAL][Combination of methods]	3.6
Progress test [PRESENCIAL][Self-study]	9.2
Study and Exam Preparation [AUTÓNOMA][Self-study]	90
Class Attendance (practical) [PRESENCIAL][Combination of methods]	13
Class Attendance (theory) [PRESENCIAL][Lectures]	11.6
Problem solving and/or case studies [PRESENCIAL][Combination of methods]	9.6
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	Apuntes de Metrología y Práctica de la Metrología Dimensional	V. Miguel	Albacete	978-84-611-9765-1	2007	

