



Teaching Guide

Teaching Guide				
Identifying Data			2018/19	
Subject (*)	Engineering Metrology and Quality Control		Code	730G03032
Study programme	Grao en Enxeñaría Mecánica			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	2nd four-month period	Third	Obligatory	6
Language	SpanishGalician			
Teaching method	Face-to-face			
Prerequisites				
Department	Enxeñaría Naval e Industrial			
Coordinador	Yañez Casal, Armando Jose	E-mail	armando.yanez@udc.es	
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	Yañez Casal, Armando Jose		armando.yanez@udc.es	
Web				
General description	The subject of Metrology and Quality Control deals with the techniques necessary for the planning and implementation of quality control in manufacturing processes. First introduced on the concepts fundamental measurement to characterize the variables that will later be used in quality control. Later, it focuses on the close relationship between the variability of the manufacturing parameters and quality end product, for day after studying such variability from a statistical viewpoint. Finally, describes the technical quality control based on statistics, which is known as statistical process control. Such techniques are aimed at finding a balance between the costs of quality control, cope with the costs of making a potential insufficient control.			

Study programme competences

Code	Study programme competences
A26	Coñecemento aplicado de sistemas e procesos de fabricación, metroloxía e control de calidade.
B1	Que os estudantes demostren posuír e comprender coñecementos nunha área de estudo que parte da base da educación secundaria xeral e adoita encontrarse a un nivel que, aínda que se apoia en libros de texto avanzados, inclúe tamén algúns aspectos que implican coñecementos procedentes da vangarda do seu campo de estudo
B2	Que os estudantes saiban aplicar os seus coñecementos ao seu traballo ou vocación dunha forma profesional e posúan as competencias que adoitan demostrarse por medio da elaboración e defensa de argumentos e a resolución de problemas dentro da súa área de estudo
B4	Que os estudantes poidan transmitir información, ideas, problemas e solucións a un público tanto especializado como leigo
B5	Que os estudantes desenvolvan aquelas habilidades de aprendizaxe necesarias para emprenderen estudos posteriores cun alto grao de autonomía
B7	Ser capaz de realizar unha análise crítica, avaliación e síntese de ideas novas e complexas
B9	Adquirir unha formación metodolóxica que garanta o desenvolvemento de proxectos de investigación (de carácter cuantitativo e/ou cualitativo) cunha finalidade estratéxica e que contribúan a situarnos na vangarda do coñecemento
C1	Utilizar as ferramentas básicas das tecnoloxías da información e as comunicacións (TIC) necesarias para o exercicio da súa profesión e para a aprendizaxe ao longo da súa vida.
C2	Desenvolverse para o exercicio dunha cidadanía aberta, culta, crítica, comprometida, democrática e solidaria, capaz de analizar a realidade, diagnosticar problemas, formular e implantar solucións baseadas no coñecemento e orientadas ao ben común.
C4	Valorar criticamente o coñecemento, a tecnoloxía e a información dispoñible para resolver os problemas cos que deben enfrontarse.
C5	Asumir como profesional e cidadán a importancia da aprendizaxe ao longo da vida.

Learning outcomes

Learning outcomes	Study programme competences
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Knowing the measurement principles that should be taken into account to make a measurement	A26	B1 B2 B4 B5 B7 B9	C1 C4 C5
Knowing the tools currently available to characterize dimensionally industrial product. Select the most appropriate to take a measurement.	A26	B1 B2 B4 B5 B7 B9	C1 C4 C5
Understanding the importance of quality control in modern manufacturing processes. Studying different types of variability, its causes and effects. Understanding variability as a measure of the quality of a manufacturing process.	A26	B1 B2 B4 B5 B7 B9	C1 C4 C5
Knowing the basic statistical tools to analyze properly the behavior of the variables that define the quality of a product. Studying the methods commonly used to verify the existence of cause-effect relationships between process variables.	A26	B1 B2 B4 B5 B7 B9	C1 C4 C5
Knowing the most common methods for statistical process control, especially control charts. Learning how to perform and interpret these graphs by using statistical software.	A26	B1 B2 B4 B5 B7 B9	C1 C4 C5
A complementary fashion, in addition to the above knowledge, characteristic of the course, students will develop their skills in teamwork, information search and management literature, writing papers, exhibition and public defense and critical analysis, among others.		B1 B2 B4 B5 B7 B9	C1 C2 C4 C5

Contents	
Topic	Sub-topic
Os bloques ou temas seguintes desenvolven os contidos establecidos na ficha da Memoria de Verificación	Medición e verificación. Unidades e patróns de medida. Metrotecnica. Principios de medición. Sistematización das causas de erros. Criterios de rechazo dunha medida. Instrumentos de medida de lonxitudes, ángulos e formas. Aa calidade na fabricación: planificación e métodos de inspección e verificación. Avaliación da calidade nas medidas, ferramentas e técnicas para avaliar a calidade e os costes. Control estatístico do proceso. Control de calidade total
1. Introduction to metrology.	1.1. Introduction and history of metrology. 1.2. Systems units. The International System. 1.3. The measurement procedure. 1.4. Uncertainty quantification 1.5. Traceability and calibration



2. Applications of metrology industry	2.1. Dimensional metrology. 2.2. Length measurement. Instrumentation. 2.3. Surface quality: Roughness 2.4. Other measures: mass, time, temperature, light intensity and electrical quantities.
3. Quality Control	3.1. Introduction to quality control 3.1.1. Historical development of quality control 3.1.2. Maintaining and improving quality 3.2. Basic tools for quality improvement 3.2.1. Data collection. 3.2.2. Diagrams and their types: Pareto, cause and effect, bivariate.
4. Variability in quality control	4.1. Causes of variability 4.2. Probabilistic models. 4.3. Comparison of two treatments. 4.4. Comparison of more than two treatments: Analysis of variance
5. Statistical Process Control	5.1. introduction 5.2. Control charts. 5.3. for variables 5.4. For attributes. 5.5. Other control charts.

Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student's personal work hours	Total hours
Guest lecture / keynote speech	A26 B1 B5 B7 B9 C1 C2 C4 C5	21	15	36
Problem solving	A26 B1 B2 B4 B5 B7 B9 C1 C2 C4 C5	16	35	51
Seminar	A26 B1 B2 B4 B5 B7 B9 C1 C2 C4 C5	8	10	18
Mixed objective/subjective test	A26 B1 B2 B4 B5 B7 B9 C1 C4	2.5	20	22.5
Supervised projects	A26 B1 B2 B4 B5 B7 B9 C1 C2 C4 C5	0	20.5	20.5
Personalized attention		2	0	2
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	Description
Guest lecture / keynote speech	Lectures which will develop the course content
Problem solving	Interactive classes in which they solve exercises representative of content covered in lectures.
Seminar	Tutoring lessons in small groups where they will analyze and discuss the issues that have a major difficulty for students and the supervised work
Mixed objective/subjective test	In addition to the various activities planned, students must take a final exam on the content of the material, which consist of a series of short questions of theory and practice, as well as two or three issues of implementation, with a total duration of approximately two hours.
Supervised projects	El alumnado deberá desarrollar y entregar una serie de ejercicios y actividades propuestas durante el curso, sobre aplicaciones concretas de algunos aspectos de la materia.

Personalized attention



Methodologies	Description
Problem solving	For any aspect that students consider appropriate, in addition to small group tutoring, six hours per week of tutoring in the time published through the UDC website.
Supervised projects	
Seminar	
	Students who have an academic exemption will not be required to attend class but must submit the same works and, in general, on the same dates as the other students of the course.

Assessment			
Methodologies	Competencies	Description	Qualification
Mixed objective/subjective test	A26 B1 B2 B4 B5 B7 B9 C1 C4	In addition to the various activities planned, students must take a final exam on the contents of the subject, which consist of a series of short questions of theory and practice, as well as two or three issues of implementation, with a total duration of approximately two hours.	80
Supervised projects	A26 B1 B2 B4 B5 B7 B9 C1 C2 C4 C5	Students must develop and deliver a series of exercises and activities proposed during the course, on the specific application of some aspects of the subject.	20

Assessment comments
O alumnado matriculado a tempo parcial deberá poñerse en contacto, a principio de curso, co profesorado para programar a realización das actividades previstas para superar a materia.
O alumnado con dispensa académica poderá solicitar a realización das titorías para desenvolver os traballos tutelados nun horario diferente ao publicado na web da UDC.

Sources of information	
Basic	- Lorenzo Sevilla y María José Martín (2008). Metrología dimensional. Universidad de Málaga - A. M. Sánchez Pérez (1999). Fundamentos de Metrología. Universidad Politécnica de Madrid - A. Prat, X. Tort-Martorell, P. Grima y L. Pozueta (1997). Métodos estadísticos: control y mejora de la calidad. Edicions UPC - William A. Levinson (2011). Statistical Process Control for Real World Applications. CRC Press - Douglas C. Montgomery (2009). Introduction to Statistical Quality Control. John Wiley and Sons, Inc. - James R. Thomson, Jacec Joronacki (2002). Statistical Process Control. Chapman & Hall / CRC - Moro Piñeiro, María. (2017). Fundamentos de metrología dimensional. Marcombo
Complementary	- AENOR (2001). Metrología Dimensional. AENOR - E. G. Schilling, D. V. Neubauer (2009). Acceptance Sampling in Quality Control. CRC Press - Centro Español de Metrología (1998). Metrología disposiciones legales. Madrid : Ministerio de Fomento, Centro Español de Metrología - Bewoor, Anand K. (2009). Metrology & Measurement/. McGraw-Hill Education - Jay Bucher, editor (2012). The metrology handbook . American Society for Quality - Kirkup, Les (2006). An Introduction to uncertainty in measurement. Cambridge : Cambridge University Press - Dotson, Connie L. (2016). Fundamentals of dimensional metrology. Boston: Cengage Learning

Recommendations
Subjects that it is recommended to have taken before
Engineering Drawing/730G03002
Physics I /730G03003
Statistics/730G03008
Subjects that are recommended to be taken simultaneously
Manufacturing Processes/730G03022
Subjects that continue the syllabus



Other comments

To help achieve a sustained immediate environment and meet the objective of action number 5: "Healthy and sustainable environmental and social teaching and research" of the "Green Campus Ferrol Action Plan": The delivery of the documentary works made in this subject: * They will be requested in virtual format and / or computer support* It will be done through Moodle, in digital format without the need to print them. If it is necessary to make them on paper: * Plastics will not be used* Double-sided prints will be made.* Recycled paper will be used.* The printing of drafts will be avoided.

(*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.