



POLITÉCNICA

INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

COORDINATION PROCESS OF  
LEARNING ACTIVITIES  
PR/CL/001



E.T.S. de Ingenieros  
Informáticos

# ANX-PR/CL/001-01

## LEARNING GUIDE

### SUBJECT

**103000487 - Software Quality Management**

### DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

### ACADEMIC YEAR & SEMESTER

2023/24 - Semester 2

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## 1. Description

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### 1.1. Subject details

<b>Name of the subject</b>	103000487 - Software Quality Management
<b>No of credits</b>	4 ECTS
<b>Type</b>	Compulsory
<b>Academic year of the programme</b>	First year
<b>Semester of tuition</b>	Semester 2
<b>Tuition period</b>	February-June
<b>Tuition languages</b>	English
<b>Degree programme</b>	10AM - Master Universitario en Ingenieria del Software
<b>Centre</b>	10 - Escuela Tecnica Superior De Ingenieros Informaticos
<b>Academic year</b>	2023-24

## 2. Faculty

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### 2.1. Faculty members with subject teaching role

<b>Name and surname</b>	<b>Office/Room</b>	<b>Email</b>	<b>Tutoring hours *</b>
Angelica De Antonio Jimenez (Subject coordinator)	5108	angelica.deantonio@upm.es	M - 10:30 - 12:00 Tu - 17:00 - 18:30 Th - 09:30 - 10:00 Th - 12:00 - 14:30 Previous appointment should be requested at <a href="mailto:angelica.deantonio@upm.es">angelica.deantonio@upm.es</a> Check tutoring hours at: <a href="https://doc">https://doc</a>

			s.google.com/spreadsheets/d/1O2EIQzNBt7pKt-rTGc6JnySNJ-VT5nCz_BPaPMiK2KY/edit?usp=sharing
Jaime Ramirez Rodriguez	5112	jaime.ramirez@upm.es	Sin horario. Previous appointment is recommended. Check tutoring hours at: <a href="https://docs.google.com/spreadsheets/d/1O2EIQzNBt7pKt-rTGc6JnySNJ-VT5nCz_BPaPMiK2KY/edit?usp=sharing">https://docs.google.com/spreadsheets/d/1O2EIQzNBt7pKt-rTGc6JnySNJ-VT5nCz_BPaPMiK2KY/edit?usp=sharing</a>

\* The tutoring schedule is indicative and subject to possible changes. Please check tutoring times with the faculty member in charge.

### 3. Skills and learning outcomes \*

#### 3.1. Skills to be learned

CE1 - Elaborar un plan de proyecto que permita coordinar y priorizar recursos y actividades para obtener los resultados esperados en los plazos, costes y calidad establecidos

CE11 - Identificar, controlar, informar y auditar la configuración de un sistema y sus cambios

CE6 - Diseñar las pruebas de los módulos y ayudar a diseñar las pruebas de integración e instalación. Realizar la integración del sistema, las pruebas de integración y la instalación.

CE7 - Elaborar un plan de verificación y validación que permita coordinar y priorizar recursos y actividades para garantizar el nivel de calidad requerido.

CG1 - Que los estudiantes sepan aplicar los conocimientos adquiridos y su capacidad de resolución de problemas

en entornos nuevos o poco conocidos dentro de contextos más amplios (o multidisciplinares) relacionados con su área de estudio (RD)

CG12 - Comprensión amplia de las técnicas y métodos aplicables en una especialización concreta, así como de sus límites

CG18 - Capacidad de trabajar y comunicarse también en contextos internacionales

CG19 - Aproximación sistemática a la gestión de riesgos

CG2 - Que los estudiantes sean capaces de integrar conocimientos y enfrentarse a la complejidad de formular juicios a partir de una información que, siendo incompleta o limitada, incluya reflexiones sobre las responsabilidades sociales y éticas vinculadas a la aplicación de sus conocimientos y juicios (RD)

CG3 - Que los estudiantes sepan comunicar sus conclusiones y los conocimientos y razones últimas que las sustentan a públicos especializados y no especializados de un modo claro y sin ambigüedades (RD)

### 3.2. Learning outcomes

RA40 - Es capaz de identificar y establecer las prácticas necesarias para gestionar la configuración de un sistema software

RA42 - Comprende la interrelación entre calidad del producto y calidad del proceso

RA43 - Conoce y aplica técnicas de control de calidad de productos y procesos

RA7 - Knows and applies quality models to identify and specify the quality attributes a software system must satisfy

RA10 - Understands the mission of a quality system and knows the applicable standards and norms

RA8 - Knows and determines the most appropriate verification and validation techniques to be applied in a software development project with the aim of assuring the quality level required

RA9 - Is able to identify and determine the practices needed to manage a software system configuration

RA11 - Understands the interrelation between product quality and process quality

RA12 - Knows and applies product and process quality control techniques

RA38 - Conoce y aplica modelos de calidad para la identificación y especificación de los atributos de calidad a satisfacer por un sistema software

RA41 - Comprende la misión de un sistema de calidad y conoce los estándares y normas aplicables

RA39 - Conoce y determina las técnicas de verificación y validación más apropiadas para aplicar en un proyecto de desarrollo de software con el objetivo de garantizar el nivel de calidad requerido

\* The Learning Guides should reflect the Skills and Learning Outcomes in the same way as indicated in the Degree Verification Memory. For this reason, they have not been translated into English and appear in Spanish.

## 4. Brief description of the subject and syllabus

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### 4.1. Brief description of the subject

The goal of the Software Quality Management subject is to provide the student with a broad overview about the different aspects involved in the development of software with a required level of quality. The following questions are addressed:

- What is the meaning of quality in the software domain?
- How can we define precisely the quality required from a software system?
- How can we measure the quality of a software system?
- How can we measure the quality of a software process?
- How can we control quality during the development of a software system?
- How can we control the configuration and evolution of a software system?
- How can we build quality into the software being developed?
- How can we manage software quality from an organizational point of view?
- How can we evaluate the cost and benefits of quality?
- How can we make factual-based decisions about the quality of a software system?

## 4.2. Syllabus

1. Introduction to Software Quality
  - 1.1. Software Quality Definition
  - 1.2. Software Quality Models
  - 1.3. Usage of a Quality Model
  - 1.4. Defects and Defect Density
2. Software Quality Control Activities
  - 2.1. Static Controls
  - 2.2. Dynamic Controls
3. Quality Metrics
  - 3.1. Product and Process Quality Metrics
  - 3.2. Comparison of Quality Control Activities
4. Quality Management and Quality Systems
  - 4.1. Introduction to Quality Management and related standards and norms
  - 4.2. The Quality System and the Quality Manual
  - 4.3. Quality Management Tools
  - 4.4. The Cost of Quality
5. Software Quality Assurance Activities
  - 5.1. Introduction to Quality Assurance
  - 5.2. Quality Construction
  - 5.3. Quality Assurance Planning
6. Software Configuration Management
  - 6.1. Basic Concepts of Software Configuration Management
  - 6.2. Configuration Identification
  - 6.3. Configuration Change Control
  - 6.4. Configuration Status Accounting
  - 6.5. Configuration Audits
  - 6.6. Configuration Management Plan

## 5. Schedule

### 5.1. Subject schedule\*

Week	Classroom activities	Laboratory activities	Distant / On-line	Assessment activities
1	<b>Chapter 1.1. Software Quality Definition</b> Duration: 02:00 Lecture			
2	<b>Chapter 1.2 Software Quality Models</b> Duration: 02:00 Lecture			<b>Reading 1 test</b> Online test Continuous assessment Not Presential Duration: 03:00
3	<b>Chapter 1.2 Software Quality Models</b> <b>Chapter 1.3 Usage of a Quality Model</b> Duration: 02:00 Lecture			<b>Analysis of a quality attribute</b> Individual work Continuous assessment Not Presential Duration: 04:00
4	<b>Chapter 1.4 Defects and Defect Density</b> Duration: 02:00 Lecture			<b>Reading 2 test</b> Online test Continuous assessment Not Presential Duration: 03:00
5	<b>Chapter 2.1 Static Controls</b> Duration: 02:00 Lecture			<b>Analysis of a defect tracking tool</b> Group work Continuous assessment Not Presential Duration: 06:00
6		<b>Exercise on inspections</b> Duration: 02:00 Laboratory assignments		<b>Inspection practice</b> Individual work Continuous assessment Presential Duration: 02:00
7		<b>Exercise on walkthroughs</b> Duration: 02:00 Laboratory assignments		<b>Analysis of inspection results</b> Individual work Continuous assessment Not Presential Duration: 02:00
8	<b>Chapter 2.2 Dynamic Controls</b> Duration: 02:00 Lecture			<b>Walkthrough practice and report</b> Group work Continuous assessment Presential Duration: 04:00
9	<b>Chapter 2.2 Dynamic Controls</b> Duration: 02:00 Lecture			<b>Reading 3 test</b> Online test Continuous assessment Not Presential Duration: 03:00



10	<p><b>Chapter 3. Quality Metrics</b> Duration: 01:00 Lecture</p>			<p><b>First Partial exam</b> Written test Continuous assessment Presential Duration: 01:00</p>
11	<p><b>Chapter 4. Quality Management</b> Duration: 02:00 Lecture</p>			<p><b>Reading 4 test</b> Online test Continuous assessment Not Presential Duration: 03:00</p>
12	<p><b>Chapter 4. Quality Management</b> Duration: 01:00 Lecture</p> <p><b>Chapter 5. Quality Assurance</b> Duration: 01:00 Lecture</p>			
13	<p><b>Chapter 6. Software Configuration Management</b> Duration: 02:00 Lecture</p>			
14	<p><b>Chapter 6. Software Configuration Management</b> Duration: 02:00 Lecture</p>			<p><b>Configuration Management exercises</b> Individual work Continuous assessment Not Presential Duration: 04:00</p>
15				<p><b>Analysis of basic quality management tools</b> Group work Continuous assessment Not Presential Duration: 05:00</p> <p><b>Presentation of work on basic quality management tools</b> Group presentation Continuous assessment Presential Duration: 02:00</p>
16				<p><b>Individual exercises (submitted after the deadline for progressive evaluation, or failed and re-submitted)</b> Individual work Final examination Not Presential Duration: 00:00</p> <p><b>Student participation</b> Other assessment Continuous assessment Presential Duration: 00:00</p> <p><b>First partial exam (if the grade obtained in progressive evaluation is below the minimum of 4)</b> Written test Final examination Presential Duration: 02:00</p> <p><b>Second partial exam</b></p>

				<p>Written test Continuous assessment Presential Duration: 02:00</p> <p><b>Reading tests</b> Online test Final examination Not Presential Duration: 12:00</p> <p><b>Group exercises (submitted after the deadline for progressive evaluation, or failed and re-submitted)</b> Group work Final examination Not Presential Duration: 00:00</p>
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Depending on the programme study plan, total values will be calculated according to the ECTS credit unit as 26/27 hours of student face-to-face contact and independent study time.

\* The schedule is based on an a priori planning of the subject; it might be modified during the academic year, especially considering the COVID19 evolution.

## 6. Activities and assessment criteria

### 6.1. Assessment activities

#### 6.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
2	Reading 1 test	Online test	No Presential	03:00	2.5%	/ 10	CG12
3	Analysis of a quality attribute	Individual work	No Presential	04:00	7%	/ 10	CE7 CG12 CG18
4	Reading 2 test	Online test	No Presential	03:00	2.5%	/ 10	CG12
5	Analysis of a defect tracking tool	Group work	No Presential	06:00	7%	/ 10	CG2 CG3 CG12 CG18 CG1 CE11
6	Inspection practice	Individual work	Face-to-face	02:00	7%	/ 10	CE7 CG1 CE6
7	Analysis of inspection results	Individual work	No Presential	02:00	3%	/ 10	CG2 CG3 CG18 CG1
8	Walkthrough practice and report	Group work	Face-to-face	04:00	8%	/ 10	CE7 CG12 CE1
9	Reading 3 test	Online test	No Presential	03:00	2.5%	/ 10	CG12 CE1
10	First Partial exam	Written test	Face-to-face	01:00	20%	4 / 10	CE6 CE7 CE1
11	Reading 4 test	Online test	No Presential	03:00	2.5%	/ 10	CG12
14	Configuration Management exercises	Individual work	No Presential	04:00	3%	/ 10	CE11
15	Analysis of basic quality management tools	Group work	No Presential	05:00	7%	/ 10	CE1 CG19

15	Presentation of work on basic quality management tools	Group presentation	Face-to-face	02:00	3%	/ 10	CG3 CG18
16	Student participation	Other assessment	Face-to-face	00:00	5%	/ 10	
16	Second partial exam	Written test	Face-to-face	02:00	20%	4 / 10	CE6 CE7 CG12 CG1 CG19 CE1 CE11

### 6.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
16	Individual exercises (submitted after the deadline for progressive evaluation, or failed and re-submitted)	Individual work	No Presential	00:00	13%	/ 10	CG2 CE7 CG3 CG12 CG18 CG1 CG19 CE11
16	First partial exam (if the grade obtained in progressive evaluation is below the minimum of 4)	Written test	Face-to-face	02:00	40%	4 / 10	CE6 CG2 CE7 CG3 CG12 CG1 CG19 CE1 CE11
16	Reading tests	Online test	No Presential	12:00	10%	/ 10	CG12
16	Group exercises (submitted after the deadline for progressive evaluation, or failed and re-submitted)	Group work	No Presential	00:00	14%	/ 10	CG2 CG3 CG12 CG18 CG1 CG19 CE11

### 6.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Extraordinary evaluation exam	Written test	Face-to-face	02:00	40%	4 / 10	CE6 CE7 CG12 CE1 CE11
Reading tests	Online test	Face-to-face	12:00	10%	/ 10	CG12
Group exercises (grade obtained in ordinary evaluation, or new submission - see conditions for submission)	Group work	Face-to-face	00:00	25%	/ 10	CG2 CG3 CG12 CG18 CG1 CG19 CE11
Individual exercises (grade obtained in ordinary evaluation, or new submission - see conditions for submission)	Individual work	Face-to-face	00:00	20%	/ 10	CE7 CG3 CG2 CG12 CG18 CG1 CG19
Student participation (grade obtained in progressive evaluation)	Other assessment	Face-to-face	00:00	5%	/ 10	

## 6.2. Assessment criteria

### Course evaluation system:

The course is graded following a progressive assessment method.

The student passes the course in ordinary evaluation only if:

- 5 or more points over 10 are obtained at the end of the course, by applying the formula:

FINAL GRADE = 40% Individual and group exercises + 15% Reading tests in Moodle + 40% Exams + 5% Student participation

- A minimum grade of 4 over 10 is obtained in each of the partial exams

The maximum grade for each of the evaluation components and the minimum grade needed to compensate non-passed parts are indicated in the following table.

	MAXIMUM GRADE  (and correspondence over the final grade)	MINIMUM GRADE TO COMPENSATE NON-PASSED PARTS
Individual and group exercises (45%)	10 (4,5)	4 over 10
Reading tests (10%). Grade computed as the average of the grade obtained in all reading tests.	10 (1,0)	-
Exams (40%). Grade computed as the average of the grade obtained in both exams.	10 (4,0)	4 over 10
Student participation (5%). Grade obtained through regular attendance to the classes, and active participation in them.	10 (0,5)	-

The grade for the Individual and group exercises component will be obtained through the following evaluation activities:

#### Individual exercises

- Analysis of a quality attribute. Impact on the final grade: 0,7
- Inspection practice. Impact on the final grade: 0,7. THIS ACTIVITY IS PERFORMED IN THE CLASSROOM AND CANNOT BE RECOVERED IN THE GLOBAL EVALUATION
- Analysis of inspection results. Impact on the final grade: 0,3.
- Configuration management exercises. Impact on the final grade: 0,3.

#### Group exercises

- Analysis of a defect tracking tool. Impact on the final grade: 0,7
- Walkthrough practice. Impact on the final grade: 0,8. THIS ACTIVITY IS PERFORMED IN THE CLASSROOM AND CANNOT BE RECOVERED IN THE GLOBAL EVALUATION
- Analysis of a basic quality management tool. Impact on the final grade: 0,7.
- Presentation of the analysis of a basic quality management tool. Impact on the final grade: 0,3. THIS ACTIVITY IS PERFORMED IN THE CLASSROOM AND CANNOT BE RECOVERED IN THE GLOBAL EVALUATION

## Global evaluation

When failed (grade below the minimum), the first partial exam should be repeated in the global evaluation date fixed in the exam calendar.

The individual and group exercises submitted after the deadline established for the progressive evaluation will be considered as submitted to the global evaluation, and consequently they will be graded at the end of the semester, without the possibility to re-submit them at the global evaluation period.

The individual and group exercises submitted before the deadline established for the progressive evaluation will be graded and, if failed (grade below the minimum), the student will be allowed to re-submit them at the global evaluation period, although re-submission is not mandatory to pass the course.

Some evaluation activities can only be performed in a progressive way, namely:

- Inspection practice. Impact on the final grade: 0,7.
- Walkthrough practice. Impact on the final grade: 0,8.
- Presentation of the analysis of a basic quality management tool. Impact on the final grade: 0,3.

Attendance to the classes in which these activities are performed is mandatory. The dates for these classes will be announced at least 14 days in advance. Students not attending these classes will be graded as 0 in the corresponding evaluation activities, without the possibility to pass them either in the global or in the extraordinary evaluation.

The Student participation will also be graded only progressively, and it will depend on attendance to the classes and active participation in the discussions. Impact on the final grade: 0,5.

## Extraordinary evaluation

When failed (grade below the minimum), any of the partial exams should be repeated in the extraordinary evaluation date fixed in the exam calendar.

Only the individual and group exercises not submitted for the ordinary evaluation (progressive or global) can be submitted for the extraordinary evaluation. For all submitted exercises, the grades obtained in ordinary evaluation will be considered for the computation of the final grade.

## 7. Teaching resources

### 7.1. Teaching resources for the subject

Name	Type	Notes
Schulmeyer, 2007	Bibliography	Gordon Schulmeyer, G. (2007) Handbook of Software Quality Assurance, Artech House Publishers, 4th ed.
Fagan, 1976	Bibliography	M.E. Fagan, Design and Code Inspections to Reduce Errors in Program Development, IBM Systems Journal, Vol. 15, Nº 3, pp. 182-210, 1976
Galin, 2003	Bibliography	D. Galin (2003) Software Quality Assurance: From Theory to Implementation, Addison-Wesley
McCall, 1977	Bibliography	J.A. McCall, P.K. Richards, G.F. Walters, Factors in Software Quality, RADC-TR-77-369, Rome Air Development Center, United States Air Force, 1977
Cianfrani, 2009	Bibliography	C.A. Cianfrani, J.J. Tsiakals, J.E. West (2009) ISO 9001:2008 Explained, ASQ Quality Press
ISO/IEC 9126-1:2001	Bibliography	ISO/IEC 9126-1:2001, Software engineering -- Product quality -- Part 1: Quality model
ISO/IEC TR 9126-2:2003	Bibliography	ISO/IEC TR 9126-2:2003, Software engineering -- Product quality -- Part 2: External metrics
ISO/IEC TR 9126-3:2003	Bibliography	ISO/IEC TR 9126-3:2003, Software engineering -- Product quality -- Part 3: Internal metrics
ISO/IEC TR 9126-4:2004	Bibliography	ISO/IEC TR 9126-4:2004, Software engineering -- Product quality -- Part 4: Quality in use metrics



IEEE 983-86	Bibliography	IEEE Guide for Software Quality Assurance Planning, ANSI/IEEE std. 983-1986, IEEE Computer Society, Software Engineering Technical Committee, Software Engineering Standards Subcommittee, 1986
IEEE 1028-2008	Bibliography	IEEE Standard for Software Reviews and Audits, ANSI/IEEE IEEE std. 1028-2008, IEEE Computer Society, Software Engineering Technical Committee, Software Engineering Standards Subcommittee, 2008
The how and why of auditing	Web resource	<a href="http://videos.asq.org/the-how-and-why-of-auditing">http://videos.asq.org/the-how-and-why-of-auditing</a>
Guidelines for the Application of ISO 9001:2000 to Computer Software	Bibliography	IEEE Guide Adoption of ISO/IEC 90003:2004 Software Engineering -Guidelines for the Application of ISO 9001:2000 to Computer Software
Subject web site	Web resource	<a href="https://moodle.upm.es/titulaciones/oficiales/course/view.php?id=2999">https://moodle.upm.es/titulaciones/oficiales/course/view.php?id=2999</a>

## 8. Other information

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### 8.1. Other information about the subject