Universidad de Alcalá

TEACHING GUIDE

Software Quality, Testing and Maintenance

Degree in
Information System Engineering (GISI)
Computer Engineering (GIC)
Computer Science Engineering (GII)

Universidad de Alcalá

Academic Year 2023/2024

4th Year - 2nd Semester (GISI+GIC+GII)

Approved by the School Board on June 12th, 2023

TEACHING GUIDE

Course Name:	**Software Quality, Testing and Maintenance**
Code:	**780043 (GISI+GIC+GII)**
Degree in:	**Information System Engineering (GISI)** **Computer Engineering (GIC)** **Computer Science Engineering (GII)**
Department and area:	**Ciencias de la Computación** **Computer Languages and Systems**
Type:	**Optional (Generic) (GISI+GIC+GII)**
ECTS Credits:	**6.0**
Year and semester:	**4th Year - 2nd Semester (GISI+GIC+GII)**
Teachers:	Por definir
Tutoring schedule:	Consultar al comienzo de la asignatura
Language:	English

1. COURSE SUMMARY

The course on Software Quality, Testing and Maintenance is included in the second semester of the fourth year of the Degree in Computer Engineering, the Degree in Computer Science Engineering or the Degree in Information Systems. The main goal of the course is training students in the foundations and basic skills of software quality assurance including techniques like software testing, software reviews and audits, software measurement and dependability analysis as well as the management of software maintenance.

Prerequisites and recommendations
It is strongly recommended having attended courses on programming and software engineering before starting this course.

2. SKILLS

Basic, Generic and Cross Curricular Skills.

This course contributes to acquire the following basic, generic and cross curricular skills:

en_CG5 - Ability to conceive, develop and maintain computer systems, services and applications using software engineering methods as an instrument for quality assurance, in accordance with the knowledge acquired as established in section 5, annex 2, of the resolution BOE-A-2009-12977.

en_CG10 - Knowledge to perform measurements, calculations, assessments, appraisals, appraisals, studies, reports, task planning and other similar computer work, in accordance with the knowledge acquired as set out in section 5, annex 2, of BOE resolution -A-2009-12977.

en_CB1 - That students have demonstrated to possess and understand knowledge in an area of study that is based on general secondary education, and is usually found at a level that, although supported by advanced textbooks, also includes some aspects that involve knowledge from the forefront of their field of study.

en_CB2 - That the students know how to apply their knowledge to their work or vocation in a professional manner and possess the competencies that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study.

en_CB3 - That students have the ability to gather and interpret relevant data (usually within their area of study) to make judgments that include a reflection on relevant social, scientific or ethical issues.

en_CB4 - That students can transmit information, ideas, problems and solutions to both a specialized and non-specialized public.

en_CB5 - That the students have developed those learning skills necessary to undertake further studies with a high degree of autonomy.

en_TRU1 - Capacity of analysis and synthesis.

en_TRU2 - Oral and written competencies.

en_TRU3 - Ability to manage information.

en_TRU4 - Autonomous learning skills.

en_TRU5 - Team work.

Specific Skills

This course contributes to acquire the following specific skills:

en_CIC6 - Ability to understand, implement and manage the guarantee and security of computer systems.

en_CSI6 - Ability to understand and apply the principles and techniques of quality management and technological innovation in organizations.

Learning Outcomes

After succeeding in this subject the students will be able to:

RA1 Identify and understand the basic concepts of software quality assurance including also those related to software configuration management.
RA2 Identify and understand basic concepts of software testing.
RA3 Analyze the coverage for a set of test cases.
RA4 Design and specify structural and/or functional test cases for an application and make use of basic support tools for its specification and execution.
RA5 Identify and understand the basic concepts of the different types of software review processes.
RA6 Identify and understand the basic concepts of software measurement.
RA7 Calculate the main product software metrics both manually and using automatic tools and evaluate the practical consequences from the obtained values
RA8 Identify and understand basic software reliability concepts and prediction models as well as to calculate reliability indicators.
RA9 Identify and understand the basic concepts of software maintenance and determine the direct and inverse relationship between code and UML

3. CONTENTS

Contents Blocks*	Total number of hours
Introduction to quality assurance and management	8 horas
Software testing	14 hours
Review and audit processes	10 hours
Software dependability	4 hours
Quality evaluation and metrics	12 hours
Software maintenance	8 hours

(*) Continuous Assessment Tests (PEI) included

The actual order does not necessarily need to follow the order indicated in the previous table. It will be adapted to the student's learning of each one of the parts in which the subject is composed.

4. TEACHING - LEARNING METHODOLOGIES. FORMATIVE ACTIVITIES.

4.1. Credits Distribution

Number of on-site hours:	58 hours (56 hours on-site +2 exams hours)
Number of hours of student work:	92
Total hours	150

4.2. Methodological strategies, teaching materials and resources

Lectures and expository classes, in combination with laboratory assignments	• Presentation and discussion of basic knowledge of the subject. • Presentation and resolution of related exercises and assumptions. • Activities oriented to the teaching of the specific competences of the subject, especially those related to the knowledge and use of quality assurance techniques.
Group and cooperative work	• Approach and development of practical exercises forsolving problems and analyzing hypotheses and contribute to the development of the ability to analyze results, teamwork, leadership, communication skills, critical reasoning and understanding of the resolution methods proposed. • Elaboration of work with individual and collective responsibility but with information management and team activities. • Sharing of information, problems and doubts that appear in the realization of the work. • Organization and realization of public conferences with oral presentations and discussion of results.
Personal study and work	• Analysis and assimilation of the contents of the subject, problem solving, bibliographic consultation, preparation of individual and group work, use of the Virtual Classroom platform with self-evaluations. • Tutorials/personal sessions: individual and group counseling during the teaching-learning process, either in person or remotely.

5. ASSESSMENT: procedures, evaluation and grading criteria

Preferably, students will be offered a continuous assessment model that has characteristics of formative assessment in a way that serves as feedback in the teaching-learning process.

5.1. PROCEDURES

The evaluation must be inspired by the criteria of continuous evaluation (Learning Assesment Guidelines, LAG, art 3). However, in compliance with the regulations of the University of Alcalá, an alternative process of final evaluation is made available to the student in accordance with the Learning Assesment Guidelines as indicated in Article 10, students will have a period of fifteen days from the start of the course to request in writing to the Director of the Polytechnic School their intention to take the non-continuous evaluation model adducing the reasons that they deem convenient. The evaluation of the learning process of all students who do not apply for it or are denied it will be done, by default, according to the continuous assessment model. The student has two calls to pass the subject, one ordinary and one extraordinary.

Ordinary Call

The evaluation system of the course will be in accordance with RD 1125/2003, which regulates the ECTS credit system. Students will be subject to the evaluation procedures as articulated in Title 2 (art. 9 and 10) of the Learning Assessment Regulations of the UAH approved in its Governing Council of March 24, 2011. Preferably, students will be offered a continuous evaluation system that has formative evaluation characteristics, so that it serves as feedback in the teaching-learning process by the student.

Continous Assessment:

The students will have to attend the laboratory sessions and make the corresponding deliveries to all the laboratory assignments. They will deliver in group the results of the laboratory assignments following the established schedule.

The evaluation will be based on the PEI tests, the group practices TA and the complementary activities ACP.

As a general criterion, the students who, in ordinary call, do not complete all the PEI or do not hand in all the TA will be considered Not Presented.

Assessment through final exam:

For students who have waived continuous assessment, the ACP grading instrument will be supplemented with the corresponding higher weight of the PEI tests. The delivery of the practical work TA1 and TA2 will be done on the date and in the format determined before the official exam day designated in the teaching planning of the degree (in which the PEI are carried out).

Extraordinary Call

Students with an evaluation of at least sufficient ability in all the RAs of one of the grading instruments in the regular exam will not have to repeat the test. Students will keep their grade in ACP. The procedure is similar to the evaluation by final exam.

5.2. EVALUATION

EVALUATION CRITERIA

The Evaluation Criteria (CE) are set according to the level of acquisition of competencies acquired by the student. The criteria are defined as follows:

CE1. The student is able of identifying and understanding the basic concepts of software quality assurance and software configuration management through questions and resolution of case studies related to specific situations in software projects.

CE2. The student is able of identifying and understanding the basic concepts of software testing through questions and resolution of case studies related to specific situations in software projects.

CE3. The student is able of designing structure-based test cases and analyze and evaluate the corresponding test coverage (both manually and using tools) for deciding how to achieve the appropriate quality level.

CE4. The student is able of designing and specifying the structure-based and/or functional tests for a specific application with tool support for their specification and execution in a practical way.

CE5. The student is able of identifying and understanding the basic concepts of the different types of software inspection/review processes through questions and case studies related to specific situations in software projects.

CE6. The student is able of identifying and understanding the basic concepts of software measurement through questions and case studies related to specific situations in software projects.

CE7. The student is able of calculating the main metrics of a specific software product, both manually and using automatic tools, and evaluating their practical consequences

CE8. The student is able of identifying and understanding the basic concepts of software reliability and Software Reliability Growth Models (SRGM) through questions and case studies. The student is able of calculating basic reliability indicators based on data from software execution in production environments.

CE9. The student is able of identifying and understanding the basic concepts of software maintenance through questions and case studies. The student is also able of determining the direct and inverse relationship between software code and their corresponding UML diagrams.

GRADING TOOLS

This section indicates the assessment instruments that will be applied to each of the evaluation criteria.
1. Intermediate Assessment Test (PEI1): theoretical and practical questions of blocks 1, 2 and 3.
2. Intermediate Assessment Test (PEI2): theoretical and practical questions of blocks 4, 5 and 6.
3. Practical Work (TA1): practical assignment based on lab work focused on software testing.
4. Practical Work (TA2): practical assignment based on lab work focused on software measurement.
5. Complementary and Participatory Activities (CPAs): Consisting in individual resolution of theoretical-practical problems as well as written works or autonomous work of students and assessment and participation through Virtual Platform.

TA1 and TA2 will be carried out in teams of 2 students throughout the established time periods, combining their autonomous work with tutoring in laboratory sessions and may include public presentations of results and/or individual tests according to their plan, so that each student's grade may be different according to their performance in these controls.

GRADING CRITERIA

In the ordinary call-continuous assessment the relationship between the competences, learning outcomes, criteria and evaluation instruments is as follows.

Skill	Learning Outcomes	Evaluation criteria	Grading Tool	Contribution to the final mark
CG5, CG10, CB1-CB5, TRU1-TRU5, CIC6, CSI6	RA1, RA2, RA3, RA4, RA5	CE1, CE2, CE3, CE4, CE5	PEI1	22,5%
CG5, CG10, CB1-CB5, TRU1-TRU5, CIC6, CSI6	RA1, RA2, RA3, RA4, RA5	CE1, CE2, CE3, CE4, CE5	TA1	22,5%
CG5, CG10, CB1-CB5, TRU1-TRU5, CIC6, CSI6	RA6, RA7, RA8, RA9	CE6, CE7, CE8, CE9	PEI2	22,5%
CG5, CG10, CB1-CB5, TRU1-TRU5, CIC6, CSI6	RA6, RA7, RA8, RA9	CE6, CE7, CE8, CE9	TA2	22,5%
CG5, CG10, CB1-CB5, TRU1-TRU5, CIC6, CSI6	RA1, RA2, RA3, RA4, RA5, RA6, RA7, RA8, RA9	CE1, CE2, CE3, CE4, CE5, CE6, CE7, CE8, CE9	ACP	10%

In the ordinary call-final evaluation, the relationship between the competences, learning outcomes, criteria and evaluation instruments is as follows.

Skill	Learning Outcomes	Evaluation criteria	Grading Tool	Contribution to the final mark
CG5, CG10, CB1-CB5, TRU1-TRU5, CIC6, CSI6	RA1, RA2, RA3, RA4, RA5	CE1, CE2, CE3, CE4, CE5	PEI1	22,5%
CG5, CG10, CB1-CB5, TRU1-TRU5, CIC6, CSI6	RA1, RA2, RA3, RA4, RA5	CE1, CE2, CE3, CE4, CE5	TA1	22,5%
CG5, CG10, CB1-CB5, TRU1-TRU5, CIC6, CSI6	RA6, RA7, RA8, RA9	CE6, CE7, CE8, CE9	PEI2	22,5%
CG5, CG10, CB1-CB5, TRU1-TRU5, CIC6, CSI6	RA6, RA7, RA8, RA9	CE6, CE7, CE8, CE9	TA2	22,5%
CG5, CG10, CB1-CB5, TRU1-TRU5, CIC6, CSI6	RA1, RA2, RA3, RA4, RA5, RA6, RA7, RA8, RA9	CE1, CE2, CE3, CE4, CE5, CE6, CE7, CE8, CE9	ACP	10%

Extraordinary call

Skill	Learning Outcomes	Evaluation criteria	Grading Tool	Contribution to the final mark
CG5, CG10, CB1-CB5, TRU1-TRU5, CIC6, CSI6	RA1, RA2, RA3, RA4, RA5	CE1, CE2, CE3, CE4, CE5	PEI1	22,5%
CG5, CG10, CB1-CB5, TRU1-TRU5, CIC6, CSI6	RA1, RA2, RA3, RA4, RA5	CE1, CE2, CE3, CE4, CE5	TA1	22,5%
CG5, CG10, CB1-CB5, TRU1-TRU5, CIC6, CSI6	RA6, RA7, RA8, RA9	CE6, CE7, CE8, CE9	PEI2	22,5%
CG5, CG10, CB1-CB5, TRU1-TRU5, CIC6, CSI6	RA6, RA7, RA8, RA9	CE6, CE7, CE8, CE9	TA2	22,5%
CG5, CG10, CB1-CB5, TRU1-TRU5, CIC6, CSI6	RA1, RA2, RA3, RA4, RA5, RA6, RA7, RA8, RA9	CE1, CE2, CE3, CE4, CE5, CE6, CE7, CE8, CE9	ACP	10%

6. BIBLIOGRAPHY

6.1. Basic Bibliography

- Topic presentations, notes and materials available on the virtual classroom
- Software Testing Foundations: A Study Guide for the Certified Tester Exam Andreas Spillner, Tilo Linz y Hans Schaefer, Rocky Nook, 2007, UAH e-books: http://proquest.safaribooksonline.com/book/software-engineering-and-development/software-testing/9781933952086
- The Handbook of Walkthroughs, Inspections, and Technical Reviews, Gerald M. Weinberg, Dorset House, 1990
- Fundamentos de la confiabilidad en desarrollo de software: enfoque y prevención, Luis Fernández Sanz, AEC, 2008, http://www.aec.es/web/guest/publicaciones/libros/pub4318
- Software metrics: a rigorous and practical approach, Norman E. Fenton, Shari Lawrence Pfleeger, PWS, 1998.
- The Handbook of Walkthroughs, Inspections, and Technical Reviews, Fletcher J. Buckley. IEEE Computer Society Press, 1996.

6.2. Additional Bibliography

- IEEE Std 1012-2004, Software Verification and Validation, IEEE, 2004.
- IEEE Std 1028-2008, IEEE Standard for Software Reviews, IEEE, 2008.
- IEEE Std 730-2002, IEEE Standard for Software Quality Assurance Plans, IEEE, 2002.
- IEEE Std 828-1998, IEEE Standard for Software Configuration Management Plans, IEEE, 1998.
- IEEE Std 829-2008, Standard for Software Test Documentation, IEEE, 2008

- IEEE Std 1219-1998, IEEE Standard for Software Maintenance, IEEE, 1998
- Metrics and Models in Software Quality Engineering ,Stephen H. Kan, Addison-Wesley Professional, 2001, UAH e-books: http://proquest.safaribooksonline.com/book/software-engineering-and-development/0201729156
- Introduction to Software Testing, Paul Ammann and Jeff Offutt, Cambridge University Press, 2008
- Implementing ITIL Configuration Management, Larry Klosterboer, IBM Press, 2007, UAH e-books: http://proquest.safaribooksonline.com/book/technology-management/itil/9780137127672

Disclosure Note

During the evaluation tests, the guidelines set out in the Regulations establishing the Rules of Coexistence of the University of Alcalá must be followed, as well as the possible implications of the irregularities committed during said tests, including the consequences for committing academic fraud according to the Regulation of Disciplinary Regime of the Students of the University of Alcalá.