



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

103000816 - Critical Software

DEGREE PROGRAMME

10AK - Master Universitario En Software Y Sistemas

ACADEMIC YEAR & SEMESTER

2023/24 - Semester 1

Index

Learning guide

1. Description.....	1
2. Faculty.....	1
3. Skills and learning outcomes	2
4. Brief description of the subject and syllabus.....	3
5. Schedule.....	5
6. Activities and assessment criteria.....	7
7. Teaching resources.....	10
8. Other information.....	10
9. Adendas.....	11

1. Description

1.1. Subject details

Name of the subject	103000816 - Critical Software
No of credits	4 ECTS
Type	Optional
Academic year of the programme	First year
Semester of tuition	Semester 1
Tuition period	September-January
Tuition languages	English
Degree programme	10AK - Master Universitario en Software y Sistemas
Centre	10 - Escuela Tecnica Superior De Ingenieros Informaticos
Academic year	2023-24

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Tomas San Feliu Gilabert	5106	tomas.sanfeliu@upm.es	Tu - 10:00 - 13:00 Th - 10:00 - 13:00
Andres Silva Vazquez (Subject coordinator)	5107	andres.silva@upm.es	Tu - 11:00 - 14:00 Th - 11:00 - 14:00

* 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

CEM1 - Identificar, a partir del estado de la cuestión, la presencia de problemas de investigación relacionados con la concepción, la construcción, el uso y la evaluación de sistemas sociotécnicos complejos que hagan un uso intensivo de software

CEM3 - Aplicar métodos de investigación relevantes a problemas abiertos en el área de la Ingeniería del Software, relacionados tanto con las características peculiares del producto software como con la gestión del desarrollo del mismo

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

CG13 - Apreciación de los límites del conocimiento actual y de la aplicación práctica de la tecnología más reciente.

CG14 - Conocimiento y comprensión de la informática necesaria para la creación de modelos de información, y de los sistemas y procesos complejos

CG17 - Habilidades de gestión y capacidad de liderar un equipo que puede estar integrado por disciplinas y niveles distintos.

CG4 - Que los estudiantes posean las habilidades de aprendizaje que les permitan continuar estudiando de un modo que habrá de ser en gran medida autodirigido o autónomo.

CG7 - Especificación y realización de tareas informáticas complejas, poco definidas o no familiares

CG8 - Planteamiento y resolución de problemas también en áreas nuevas y emergentes de su disciplina

CG9 - Aplicación de los métodos de resolución de problemas más recientes o innovadores y que puedan implicar el uso de otras disciplinas

CG120 - Adquirir conocimientos científicos avanzados del campo de la informática que le permitan generar nuevas ideas dentro de una línea de investigación.

CG123 - Capacidad de leer y comprender publicaciones dentro de su ámbito de estudio/investigación, así como su catalogación y valor científico

3.2. Learning outcomes

RA115 - Knowledge of the techniques to elicitate potential hazards related to the development and use of complex Software-based devices and applications

RA114 - Understand Software limits and frontiers at the time of conceiving and developing systems with possible hazardous impacts on its environment.

RA116 - Knowledge of the main techniques used to eliminate, reduce or control Software-related hazards, including techniques for damage reduction

* 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

4.1. Brief description of the subject

The subject provides an introduction to the main concepts and, specially, to the mindset needed for understanding and managing the hazardous behaviours related to complex software systems.

4.2. Syllabus

1. Safeware concepts
 - 1.1. Normal Accidents theory
 - 1.2. Basic Concepts
 - 1.3. Reliability vs. Safety
 - 1.4. Hazard & Risk Analysis
 - 1.5. Common Techniques
2. Design and Safeware
 - 2.1. Hazard elimination
 - 2.2. Hazard reduction
 - 2.3. Hazard control
 - 2.4. Examples

3. Concepts from the IEC61508 Standard

3.1. Introduction to IEC61508

3.2. Concepts: SIL, functional safety, etc.

3.3. Hazard log

3.4. Limits of IEC61508

4. Human and Organizational Factors

4.1. Performance models

4.2. Human error

4.3. Organizational problems

4.4. Solution proposals

5. Schedule

5.1. Subject schedule*

Week	Classroom activities	Laboratory activities	Distant / On-line	Assessment activities
1	Lecture/workshop on topics 1.1 and 1.2 Duration: 02:00 Cooperative activities			
2	Lecture/workshop on topic 1.3 Duration: 02:00 Cooperative activities			Elaboration of the presentation and draft of the expository writing. Group presentation Continuous assessment Not Presential Duration: 04:00
3	Lecture/workshop on topic 1.4 Duration: 02:00 Cooperative activities			
4	Lecture/workshop on topic 1.5 Duration: 02:00 Cooperative activities			Elaboration of the presentation and draft of the expository writing. Group presentation Continuous assessment Not Presential Duration: 04:00
5	Lecture/workshop on topic 2.1 Duration: 02:00 Cooperative activities			
6	Lecture/workshop on topic 2.2 Duration: 02:00 Cooperative activities			Elaboration of the presentation and draft of the expository writing. Group presentation Continuous assessment Not Presential Duration: 04:00
7	Lecture/workshop on topic 2.3 Duration: 02:00 Cooperative activities			
8	Lecture/workshop on topic 2.4 Duration: 02:00 Cooperative activities			Elaboration of the presentation and draft of the expository writing. Group presentation Continuous assessment Not Presential Duration: 04:00
9	Lecture/workshop on topic 3.1 Duration: 02:00 Cooperative activities			
10	Lecture/workshop on topic 3.2 Duration: 02:00 Cooperative activities			Elaboration of the presentation and draft of the expository writing. Group presentation Continuous assessment Not Presential Duration: 04:00

11	Lecture/workshop on topic 3.3 Duration: 02:00 Cooperative activities			
12	Lecture/workshop on topic 3.4 Duration: 02:00 Cooperative activities			Elaboration of the presentation and draft of the expository writing. Group presentation Continuous assessment Not Presential Duration: 04:00
13	Lecture/workshop on topic 4.1 Duration: 02:00 Cooperative activities			
14	Lecture/workshop on topic 4.2 Duration: 02:00 Cooperative activities			Elaboration of the presentation and draft of the expository writing. Group presentation Continuous assessment Not Presential Duration: 04:00
15	Lecture/workshop on topics 4.3 and 4.4 Duration: 02:00 Cooperative activities			Final expositions and overall conclusions. Group presentation Continuous assessment Not Presential Duration: 04:00
16				
17				Final examination for those students whose average mark is lower than 5. Written test Final examination Presential Duration: 05:00

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	Elaboration of the presentation and draft of the expository writing.	Group presentation	No Presential	04:00	20%	3 / 10	CG8 CG4 CG9 CG7
4	Elaboration of the presentation and draft of the expository writing.	Group presentation	No Presential	04:00	20%	3 / 10	CG12 CG9 CG7 CG8 CG4
6	Elaboration of the presentation and draft of the expository writing.	Group presentation	No Presential	04:00	10%	3 / 10	CG13 CG9 CG7 CG8 CG4
8	Elaboration of the presentation and draft of the expository writing.	Group presentation	No Presential	04:00	10%	3 / 10	CG14 CG9 CG7 CG8 CG4
10	Elaboration of the presentation and draft of the expository writing.	Group presentation	No Presential	04:00	10%	3 / 10	CG17 CG9 CG7 CG8 CG4
12	Elaboration of the presentation and draft of the expository writing.	Group presentation	No Presential	04:00	10%	3 / 10	CGI20 CGI23 CG9 CG7 CG8 CG4
14	Elaboration of the presentation and draft of the expository writing.	Group presentation	No Presential	04:00	10%	3 / 10	CEM1 CG9 CG7 CG8 CG4 CG12 CGI20

15	Final expositions and overall conclusions.	Group presentation	No Presential	04:00	10%	3 / 10	CEM1 CEM3 CG9 CG7 CG8 CG4 CGI23
----	--	--------------------	---------------	-------	-----	--------	---

6.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
17	Final examination for those students whose average mark is lower than 5.	Written test	Face-to-face	05:00	100%	5 / 10	CG12 CG13 CG14 CG17 CGI20 CGI23 CEM1 CEM3 CG9 CG7 CG8 CG4

6.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Final examination.	Written test	Face-to-face	05:00	100%	5 / 10	CG12 CG13 CG14 CG17 CGI20 CGI23 CEM1 CEM3 CG9 CG7 CG8 CG4

6.2. Assessment criteria

The grading criteria for this subject are closely linked to the working methods. This method will be concept-oriented. For each topic and subtopic there will be a lecture/workshop in the classroom, and the teacher will choose a key concept. Later, the students, preferably in groups, will have one week for reading concept-related bibliography and elaborate a presentation and an expository writing (8 pages max.).

Each group of students will present a draft of their work in the classroom, which may be evaluated (anonymously) by the other students. The rhythm of work will be, approximately, as follows: every two weeks, each group of students will submit the expository writing of past week's concept. In parallel, the students will attend the lectures/workshops that will be done in the classroom, and possibly qualify them.

With more detail, the following two-week procedure will be followed for each concept:

1. The teacher will provide an introduction to a concept, relevant bibliography and documentation for the concept at hand. Such documentation will be a starting point for the student, who will explore other relevant sources of information.
2. Each group of students will elaborate a presentation related to the concept. In parallel, they should start elaborating a draft document with the expository writing of the concept.
3. The following week, in the classroom, the concept will be presented, the mistakes and problems detected in the presentation will be discussed and a consensus will be achieved. The rest of the students in the classroom may evaluate the presentations.
4. The final expository writing (8 pages max.) will be uploaded to Moodle.

The concepts of the course are listed below, but they could be dynamically modified, along the course. For some topics the teacher will provide problems for being solved by the group: Hazard. Reliability vs. Safety. Risk. SafeWare and associated techniques. Concepts from the Std. IEC 61508: SIL, ALARP. Automation and Overautomation. Norman's Model. Latent errors and violations. Models: STAMP (Leveson), ChiDeltas (Hall-Silva). Other concepts to be announced.

The mechanics of the course will be as follows:

- The communication among the students and the teacher will be done through Moodle. The steps to be done at each point during the course will be announced always through Moodle.
- Problem resolution and clarification of student's questions will be done also through Moodle.
- The documentation for each concept will be provided on demand, via Moodle.
- The purpose of evaluating the presentations by other students is to get an idea on how clear the concept has been explained. Of course, those qualifications are just informative for the teacher, who will have a final

decision on the overall evaluation.

The final qualification will be an average of the teacher's qualifications for each submitted work, taking into account also the effort and overall attitude of each group of students.

7. Teaching resources

7.1. Teaching resources for the subject

Name	Type	Notes
Bibliography	Bibliography	Bibliographic references compiled in: https://www.mendeley.com/community/critical-sw

8. Other information

8.1. Other information about the subject

The schedule follows an ideal, theoretical planning of the subject, and may undergo modifications during the course derived from any abnormal situation, like it happened with COVID-19.

9. Adendas

- La asignatura se impartirá en Español.