



# Critical Software

## Learning Guide – Information for Students

### 1. Description

<b>Grade</b>	EMSE
<b>Module</b>	
<b>Area</b>	
<b>Subject</b>	Critical Software
<b>Type</b>	Optative
<b>ECTS credits</b>	3
<b>Responsible department</b>	DLSIIS
<b>Major/Section/</b>	

<b>Academic year</b>	2012/2013
<b>Term</b>	1st term, 2nd half
<b>Language</b>	English / Spanish
<b>Web site</b>	



## 2. Faculty

<b>NAME and SURNAME</b>	<b>OFFICE</b>	<b>email</b>
Andrés Silva Vázquez (Coord.)	5107	asilva@fi.upm.es

## 3. Prior knowledge required to take the subject

<b>Passed subjects</b>	<ul style="list-style-type: none"><li>•</li></ul>
<b>Other required learning outcomes</b>	<ul style="list-style-type: none"><li>•</li></ul>



## 4. Learning goals

<b>SUBJECT-SPECIFIC COMPETENCES AND PROFICIENCY LEVEL</b>		
<b>Code</b>	<b>Competence</b>	<b>Level</b>
SC13	To have a vision of the different specific and emergent aspects of the Software Engineering, and to go further in some of them.	S
SC14	To understand what nowadays software engineering procedures can and cannot reach, their limitations and their possible future evolution.	S

Proficiency level: knowledge (K), comprehension (C), application (A), and analysis and synthesis (S)



<b>SUBJECT LEARNING OUTCOMES</b>			
<b>Code</b>	<b>Learning outcome</b>	<b>Related competences</b>	<b>Proficiency level</b>
LR1	Given a specific software engineering field, the student assesses and designs the most appropriate solution to solve some of its problems, presenting the technical difficulties and applicability limitations.	SC13, SC14	S
LR2	Given a real problem, the student chooses the most appropriate software engineering solution, analyzing the solution feasibility, what can and cannot be achieved through the current status of the chosen solution, and what it can advance in the future.	SC14	A
LR3	The student explains what are the software engineering limits and frontiers, and the base for new trends and developments, and about the advanced issues and their application.	SC13, SC14	A



## 5. Subject assessment system

ACHIEVEMENT INDICATORS		
Ref	Indicator	Related to LR
I1	Choose the appropriate techniques for hazard elimination, reduction or control, given a particular situation, and justify their appropriateness.	LR1
I2	Identify the Safety Integrity Level (SIL) and the residual risk associated with particular design decisions.	LR2
I3	Choose and apply the accident model better suited for a particular situation and related factors.	LR3

CONTINUOUS ASSESSMENT			
Brief description of assessable activities	Time	Place	Weight in grade
To carry out expositive writing and analysis tasks related to the topics of Theme 1	Week 2	Moodle	25%
To carry out expositive writing and analysis tasks related to the topics of Theme 2	Week 4	Moodle	25%
To carry out expositive writing and analysis tasks related to the topics of Theme 3	Week 6	Moodle	25%
To carry out expositive writing and analysis tasks related to the topics of Theme 4	Week 8	Moodle	25%
			<b>Total: 100%</b>



## GRADING 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 will 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 will qualify them. With more detail, the following two-week procedure will be followed for each concept:

- The teacher will provide 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.
- After some days, each group of students will elaborate a presentation. In parallel, they should start elaborating a draft document with the expository writing of the concept.
- 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 will evaluate the presentations.
- 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. In some cases 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.

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.



## 6. Contents and learning activities

SPECIFIC CONTENTS		
Unit / Topic / Chapter	Section	Related indicators
<b>Topic 1: Safeware concepts</b>	1.1 Normal Accidents Theory	I1
	1.2 Basic Concepts	I1
	1.3 Reliability vs. Safety	I1
	1.4 Hazard & Risk Analysis	I1, I3
	1.5 Common techniques	I1, I3
<b>Topic 2: Design and Safeware</b>	2.1 Hazard elimination	I1
	2.2 Hazard reduction	I1
	2.3 Hazard control	I1
	2.4 Examples	I1
<b>Topic 3: Concepts from the IEC61508 Standard</b>	3.1 Introduction to IEC61508	I2
	3.2 Concepts: SIL, functional safety, etc.	I2
	3.3 Hazard Log	I2
	3.4 Limits of IEC61508	I2
<b>Topic 4: Human and organizational factors</b>	4.1 Performance Models	I3
	4.2 Human error	I3
	4.3 Organizational problems	I3
	4.4 Solution proposals	I3, I1



## 7. Brief description of organizational modalities and teaching methods

<b>TEACHING ORGANIZATION</b>		
<b>Scenario</b>	<b>Organizational Modality</b>	<b>Purpose</b>
	<b>Theory Classes</b>	<i>Talk to students</i>
	<b>Seminars/Workshops</b>	<i>Construct knowledge through student interaction and activity</i>
	<b>Practical Classes</b>	<i>Show students what to do</i>
	<b>Placements</b>	<i>Round out student training in a professional setting</i>
	<b>Personal Tutoring</b>	<i>Give students personalized attention</i>
	<b>Group Work</b>	<i>Get students to learn from each other</i>
	<b>Independent Work</b>	<i>Develop self-learning ability</i>



<b>TEACHING METHODS</b>		
	<b>Method</b>	<b>Purpose</b>
	<b>Explanation/Lecture</b>	<i>Transfer information and activate student cognitive processes</i>
	<b>Case Studies</b>	<i>Learning by analyzing real or simulated case studies</i>
	<b>Exercises and Problem Solving</b>	<i>Exercise, test and practice prior knowledge</i>
	<b>Problem-Based Learning (PBL)</b>	<i>Develop active learning through problem solving</i>
	<b>Project-Oriented Learning (POL)</b>	<i>Complete a problem-solving project applying acquired skills and knowledge</i>
	<b>Cooperative Learning</b>	<i>Develop active and meaningful learning through cooperation</i>
	<b>Learning Contract</b>	<i>Develop independent learning</i>

Known as explanation, this teaching method involves the “*presentation of a logically structured topic with the aim of providing information organized according to criteria suited for the purpose*”. This methodology, also known as *lecture*, mainly focuses on the verbal exposition by the teacher of contents on the subject under study. The term *master class* is often used to refer to a special type of lecture taught by a professor on special occasions

Intensive and exhaustive analysis of a real fact, problem or event for the purpose of understanding, interpreting or solving the problem, generating hypotheses, comparing data, thinking, learning or diagnosis and, sometimes, training in possible alternative problem-solving procedures.

Situations where students are asked to develop the suitable or correct solutions by exercising routines, applying formulae or running algorithms, applying information processing procedures and interpreting the results. It is often used to supplement lectures.

Teaching and learning method whose starting point is a problem, designed by the teacher, that the student has to solve to develop a number of previously defined competences.

Teaching and learning method where have a set time to develop a project to solve a problem or perform a task by planning, designing and completing a series of activities. The whole thing is based on developing and applying what they have learned and making effective use of resources.

Interactive approach to the organization of classroom work where students are responsible for their own and their peers’ learning as part of a co-responsibility strategy for achieving group goals and incentives. This is both one of a number of methods for use and an overall teaching approach, or philosophy.

An agreement between the teacher and student on the achievement of learning outcomes through an independent work proposal, supervised by the teacher, and to be accomplished within a set period. The essential points of a learning contract are that it is a written agreement, stating required work and reward, requiring personal involvement and having a time frame for accomplishment.



**BRIEF DESCRIPTION OF THE ORGANIZATIONAL MODALITIES AND TEACHING METHODS**

<b>THEORY CLASSES</b>	The teacher will carry out a verbal exposition of the main concepts of the subject matter. Audiovisual and documentary resources will be used accordingly.
<b>PROBLEM-SOLVING CLASSES</b>	This is a compliment to theory classes. The students will solve problems and, or, exercises in order to apply the learned concepts and solidify the knowledge acquired.
<b>PRACTICAL WORK</b>	The teacher asks the students to solve a practical problem from a realistic situation. The student will use the knowledge recently acquired in order to solve it.
<b>INDIVIDUAL WORK</b>	Each student will work autonomously with the purpose of preparing a presentation or an essay. The student will gather relevant information from different resources: library, web, etc.
<b>GROUP WORK</b>	This work compliments individual work. The goal is to achieve a cooperative learning by working together in an essay or expository writing.
<b>PERSONAL TUTORING</b>	The students, both in group or individually, will attend tutoring sessions by the teacher, until they solidify the acquired knowledge.



## 8. Teaching resources

TEACHING RESOURCES	
<b>RECOMMENDED READING</b>	All bibliographic references are online, compiled with the online tool <a href="http://www.citeulike.org/user/asilva/tag/master">CiteULike</a> . For this subject, recommended references are those listed on <a href="http://www.citeulike.org/user/asilva/tag/master">http://www.citeulike.org/user/asilva/tag/master</a> . Other references about safety are available on <a href="http://www.citeulike.org/user/asilva/tag/safety">http://www.citeulike.org/user/asilva/tag/safety</a> .
<b>WEB RESOURCES</b>	Subject web site ( <a href="http://">http://</a> )
	Subject Moodle site ( <a href="http://">http://</a> )
<b>EQUIPMENT</b>	Assigned Classroom
	Library
	Group work room



## 9. Subject schedule

Week	Classroom activities	Lab activities	Individual work	Group work	Assessment activities	Others
Week 1 (11 hours)	• Lecture/Workshop on topics 1.1 y 1.2 (2 hours)	•	• Individual Study (1 hour) • Search for information (3 hour)	• Elaboration of the presentation and draft of the expository writing (5 h)	•	•
Week 2 (10 hours)	• Lecture/Workshop on topics 1.3, 1.4 and 1.5 (2 hours)	•	• Individual Study (1 hour) • Search for information (2 hour)	• Finishing the expository writing (5 hour)	•	•
Week 3 (10 hours)	• Lecture/Workshop on topics 2.1 and 2.2 (2 hours)	•	• Individual Study (1 hour) • Search for information (2 hour)	• Elaboration of the presentation and draft of the expository writing (5 h)	•	•
Week 4 (10 hours)	• Lecture/Workshop on topics 2.3 and 2.4 (2 hours)	•	• Individual Study (1 hour) • Search for information (2 hour)	• Finishing the expository writing (5 hour)	•	•
Week 5 (10 hours)	• Lecture/Workshop on topics 3.1 and 3.2 (2 hours)	•	• Individual Study (1 hour) • Search for information (2 hour)	• Elaboration of the presentation and draft of the expository writing (5 h)	•	•
Week 6 (10 hours)	• Lecture/Workshop on topics 3.3 and 3.4 (2 hours)	•	• Individual Study (1 hour) • Search for information (2 hour)	• Finishing the expository writing (5 hour)	•	•
Week 7 (10 hours)	• Lecture/Workshop on topics 4.1 and 4.2 (2 hours)	•	• Individual Study (1 hour) • Search for information (2 hour)	• Elaboration of the presentation and draft of the expository writing (5 h)	•	•



Week 8 (10 hours)	• Lecture/Workshop on topics 4.3 and 4.4 (2 hours)	•	• Individual Study (1 hour) • Search for information (2 hour)	• Finishing the expository writing (5 hour)	•	•
----------------------	---	---	--	--	---	---

Note: Student workload specified for each activity in hours