Universitat de les Illes Balears

Teaching guide

Academic year	2016-17
Subject	11558 - Critical Embedded Systems
Group	Group 1, 1S
Teaching guide	B
Language	English

Subject identification

Subject	11558 - Critical Embedded Systems
Credits	0.72 de presencials (18 hours) 2.28 de no presencials (57 hours) 3 de totals (75 hours).
Group	Group 1, 1S (Campus Extens)
Teaching period	First semester
Teaching language	English

Professors

Lecturers	Horari d'atenció als alumnes					
	Starting time	Finishing time	Day	Start date	Finish date	Office
Julián Proenza Arenas julian.proenza@uib.es	You need to book a date with the professor in order to attend a tutorial.					

Contextualisation

This subject is included within the itinerary called "Distributed and Embedded Computing", which is one of the possible choices for the "Information Technology" module. Therefore the subject is compulsory for any student who opts for this itinerary.

The subject purports to initiate the students in the basics of critical embedded systems, in such a way that they could acquire some minimum knowledge, that could later on be expanded to allow its use both in industrial and academic activities, including the research in this area.

The learning goals of the subject are:

1 Understanding the theoretical and practical fundamentals of critical embedded systems
2 Knowing qualitative and quantitative evaluation techniques that are habitually used for this type of systems

Requirements

Recommendable

Basic knowledge of the structure and operation of computers and computer systems.

Skills

There are basic skills that correspond to all subjects of the master's programs taught at UIB. The list of these skills can be found by clicking on the link http://estudis.uib.es/en/master/comp_basiques/

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Next, both the specific and generic skills that will be partially acquired in this subject are indicated.

Specific

* CE4 - Model, design, and define architectures, implement, manage, operate and maintain computer applications, networks, systems, services and content.
* CE9 - Design and evaluate operating systems and servers and applications and systems based on distributed computing.
* CE11 - Design and develop computer systems, applications and services in embedded and ubiquitous systems.

Generic

* CG4 - Undertake mathematical modelling, calculation and simulation in technological centres and engineering companies, especially in research, development and innovation tasks in all areas related to computer engineering.
* CG8 - Integrate and apply the knowledge acquired and solve problems in new or little-known situations within broader (or multidisciplinary) contexts.
* CG10 - Apply the principles of economy and management of human resources and projects, along with legislation, regulations and standards in computer science.

Basic

* You may consult the basic competencies students will have to achieve by the end of the Master's degree at the following address: http://estudis.uib.cat/master/comp_basiques/

Content

Theme content

1. Relevance of dependability in embedded systems
2. Basic concepts related to dependability
3. Adding fault tolerance to embedded systems
4. Relevance and problems of distribution
5. Safety-critical systems
6. Design and evaluation of fault-tolerant distributed embedded systems

Teaching methodology

In-class work activities

Modality	Name	Typ. Grp.	Description	Hours
Theory classes	Master classes	Large group (G)	The lecturer will describe the theoretical and practical fundamentals of the different topics covered in the course. In addition, for each topic the lecturer will provide information on the recommended working method and materials that	10.5

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Modality	Name	Typ. Grp.	Description	Hours
			students should use to autonomously study the subject. These master classes will be distributed throughout the semester. Each session will last either 2 or 3 hours, during which the theoretical descriptions and the resolution of exercises and problems will alternate.	
Laboratory classes	Laboratory	Medium group (M)	Practical sessions related to the modelling and evaluation of critical systems will be organized. These will allow verifying the correct understanding of the techniques described in the theoretical sessions.	4.5
Assessment	Oral defence of the practical exercices	Large group (G)	The student will do an oral examination at the end of the semester in order to defend the work carried out in the practical part of the course. This evaluation will assess whether the student knows how to correctly use the procedures and techniques related to some practical aspects of the subject.	1
Assessment	Presentation of a revision of a research paper	Large group (G)	The student will do an oral presentation (using her or his own slides) at the end of the semester in order to describe in a pedagogic manner a revision of a research paper on the design of a complete fault-tolerant system. The specific aspects to describe by the student would have been previously agreed between the student and the lecturer. This presentation will allow assessing if the student is competent to autonomously interpret and assimilate descriptions of fault-tolerant systems, by using the concepts presented in the theory classes.	1
Assessment	Written exam	Large group (G)	The student will do a written examination at the end of the semester. This evaluation will assess whether the student has understood the theory and if she or he knows how to correctly use the procedures and techniques that have been presented during the course. The numerical scoring criteria will be provided together with the exam questions.	1

At the beginning of the semester a schedule of the subject will be made available to students through the UIBdigital platform. The schedule shall at least include the dates when the continuing assessment tests will be conducted and the hand-in dates for the assignments. In addition, the lecturer shall inform students as to whether the subject work plan will be carried out through the schedule or through another way included in the Campus Extens platform.

Distance education work activities

Modality	Name	Description	Hours
Individual self-study	Study to assimilate the theory described in the sessions.	Each student will have to devote some time to individually assimilate the theoretical contents that were presented by the lecturer in the sessions.	15
Group or individual self-study	Completion of the practical exercises started in the laboratory	Each student will have to devote some extra time (besides the time established in the course schedule) to complete the resolution of the problems proposed in the laboratory sessions. The solutions to these problems will have to be delivered for the lecturer to score them. Moreover, the student will have to devote some additional time to prepare the oral presentation to the lecturer.	21

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Modality	Name	Description	Hours
Group or individual self-study	Revision of a research paper	Each student will have to devote some time to complete a revision of a research paper on the design of a complete fault-tolerant system. The specific aspects to describe by the student would have been previously agreed between the student and the lecturer. The student will prepare some slides to assist in the later presentation of the revision. The goal of the presentation is to demonstrate that the student is competent to autonomously assimilate and describe to his or her pairs descriptions of critical systems, by using the concepts presented in the theory classes. Therefore the student will have to devote some time to the preparation of the presentation to be performed for all the other students of the subject.	21

Specific risks and protective measures

The learning activities of this course do not entail specific health or safety risks for the students and therefore no special protective measures are needed.

Student learning assessment

The skills that have to be acquired in this course will be evaluated by means of a series of assessment procedures associated to each evaluative activity. The table in this section describes, for each evaluative activity, the evaluation technique that will be used, the type of evaluation (recoverable or non-recoverable), the scoring criteria and the weight of the mark in the final mark of the subject (depending on the specific evaluative itinerary). This subject considers a single evaluative itinerary (labelled “A”) which is suitable both for students who can attend to all the sessions and for those who cannot. The students commit themselves to perform all the activities included in the “A” itinerary.

The student will get a numeric mark comprised between 0 and 10 for each evaluative activity. This mark will be used (with the corresponding weight) to compute the final mark of the subject. In order to pass the student must get a minimum of 5 points in each evaluative activity.

Any student that takes the written exam will be considered as evaluated and will get a final mark.

Oral defence of the practical exercices

Modality	Assessment
Technique	Oral tests **(non-retrievable)**
Description	The student will do an oral examination at the end of the semester in order to defend the work carried out in the practical part of the course. This evaluation will assess whether the student knows how to correctly use the procedures and techniques related to some practical aspects of the subject.
Assessment criteria	Correctness of the design and implementation of the solutions proposed for the practical exercises. Correctness of the answers and explanations given during the interview with the lecturer

Final grade percentage: 20% with minimum grade 5

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Presentation of a revision of a research paper

Modality	Assessment
Technique	Oral tests **(non-retrievable)**
Description	The student will do an oral presentation (using her or his own slides) at the end of the semester in order to describe in a pedagogic manner a revision of a research paper on the design of a complete fault-tolerant system. The specific aspects to describe by the student would have been previously agreed between the student and the lecturer. This presentation will allow assessing if the student is competent to autonomously interpret and assimilate descriptions of fault-tolerant systems, by using the concepts presented in the theory classes.
Assessment criteria	Accuracy and depth of the revision of the research paper. Clarity and correctness of the presentation and quality of the slides. Correctness of the answers and explanations given during the interview with the lecturer

Final grade percentage: 40% with minimum grade 5

Written exam

Modality	Assessment
Technique	Other methods **(non-retrievable)**
Description	The student will do a written examination at the end of the semester. This evaluation will assess whether the student has understood the theory and if she or he knows how to correctly use the procedures and techniques that have been presented during the course. The numerical scoring criteria will be provided together with the exam questions.
Assessment criteria	Correctness of the answers which have to be properly explained and justified

Final grade percentage: 40% with minimum grade 5

Resources, bibliography and additional documentation

Basic bibliography

* J-C Laprie, 'Dependability: Basic Concepts and Terminology'. Springer-Verlag Wien New York, 1992.
* R. A. Sahner, K. S. Trivedi, and A. Puliafito, 'Performance and Reliability Analysis of Computer Systems'. Kluwer Academic Publisher, 101 Philip Drive, Assinippi Park, Norwell, Massachusetts 02061, USA, 1996.

Complementary bibliography

* H. Kopetz, 'Real-Time Systems: Design Principles for Distributed Embedded Applications', Kluwer Academic Publishers, 1997.
* J. Knight, 'Fundamentals of Dependable Computing for Software Engineers', CRC Press, Taylor and Francis Group, 2012.

Other resources

* Official page of the UPPAAL model checker: http://www.uppaal.org
* Official page of the Möbius evaluation tool: https://www.mobius.illinois.edu

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