Universidad de Alcalá

TEACHING GUIDE

Software for Aerospace Applications

Master in
Telecommunication Engineering

Universidad de Alcalá

Academic Year 2021/2022

2nd Year - 1st Semester

Approved by the School Board on July 6, 2021

TEACHING GUIDE

Course Name:	**Software for Aerospace Applications**
Code:	**201831**
Master in:	**Telecommunication Engineering**
Department and area:	**Automática** **Computer Architecture and Technology**
Type:	**Optional (Specialized)**
ECTS Credits:	**6.0**
Year and semester:	**2nd Year, 1st Semester**
Teachers:	Por definir
Tutoring schedule:	Consultar al comienzo de la asignatura
Language:	Spanish /English Friendly

1. COURSE SUMMARY

This course is oriented to provide the students those techniques that enable them to develop embedded software for aerospace systems. The acquired knowledge includes aspects related to the specification, design, implementation, validate and verification of this kind of systems.

2. SKILLS

Basic, Generic and Cross Curricular Skills.

This course contributes to acquire the following generic skills, which are defined in the Section 3 of the Annex to the Orden CIN/355/2009:

en_CGT1 - Skill of analysis and synthesis.

en_CGT2 - Skill of organization and planning.

en_CGT3 - Skill to analyze and search for information from diverse sources

en_CGT4 - Skill to make decisions.

en_CGT5 - Skill to adapt to new situations.

en_CB6 - To have and understand knowledges that provide a basis or opportunity to be original in the development and/or application of ideas, often in a research context

en_CB7 - That students know how to apply the acquired knowledge and problem-solving abilities in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of study.

en_CT1 - Troubleshooting skill

en_CT2 - Ethical commitment to work

en_CT5 - Motivation for quality

en_CT6 - Ability to integrate knowledge from different scientific areas

Learning Outcomes

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

RA1. Describe the design standards and regulations, legislation and problems associated with space engineering and security and defence systems.

RA2. Describe the process of specification, design, construction, verification and documentation of software used in aerospace and defence systems.

RA3. Be able to program software used in environments specific to aerospace and defence systems.

3. CONTENTS

Contents Blocks	Total number of hours
Block 1. · Introduction to Aerospace Software Systems · Concepts, methods and tools for the specification, design, construction, verification and documentation of software systems in aerospace projects. · Standards applicable to aerospace software	36 hours
Block 2. · Embedded real-time software systems. Schedulabilty Analysis · Real-time operating systems in aerospace environments.	24 hours

4. TEACHING - LEARNING METHODOLOGIES. FORMATIVE ACTIVITIES.

4.1. Credits Distribution

Number of on-site hours:	60 hours
Number of hours of student work:	90
Total hours	150

4.2. Methodological strategies, teaching materials and resources

Attendance Lessons	**Master classes**: these classes will be given in large groups and in them, the teacher will develop the most important concepts for the comprehension of the contents of the subject. **Practical cases resolution**: they will be done in small groups. During the sessions several problems susceptible of resolution will be raised by means of techniques exposed in class. These techniques will be applied in a guided way to solve the problem. **Presentation of works**: the student will have to present a work memory that he has carried out individually or in small groups. Presentations will make use of appropriate multimedia techniques. **Intermediate assessments**: during the development of the course the teacher will propose several intermediate assessments to review the acquisition of knowledge and their application.
Autonomous work	**Readings** **Activities**: exercises, concept maps, examples, searching for information. **Forum and activities participation**, using the course webpage.
Tutorial classes	Tutorial classes can be in groups as well as individuals. During these sessions, the teacher will be able to evaluate the acquisition of competences and will review the reports provided by the students on the work entrusted

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 (last modified in the Governing Board of October 31, 2019) 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 (Continous Assessment and Assessment through final exam)

In the ordinary call, there are two possible ways of evaluation: Continuous Assessment and Assessment through Final Exam. The student will be assessed preferably by means of the continuous assessment process. In order to take the final exam process, the student must apply in writing to the head of the polytechnic school within the first two weeks of joining the course, indicating the reasons that prevent him/her from following the continuous assessment system. The head of the polytechnic school will communicate the resolution within a maximum of 15 days. If no reply is received, the request will be considered accepted.

Extraordinary Call

The procedure will be the same as that described for the assessment by means of a final exam in the ordinary call.

5.2. EVALUATION

EVALUATION CRITERIA

The assessment criteria measure the level in which the competences have been acquired by the student. For that purpose, the following are defined::

CE1: The student has acquired knowledge about real time systems that require software design for aerospace applications.
CE2: The student has acquired knowledge about the process of developing aerospace applications.
CE3: The student shows the ability to apply and integrate the contents to problems, scenarios or case studies related to the subject.
CE4: The student shows ability to develop aerospace applications using methodologies and development environments specific to this type of applications.
CE5: The student fulfills the assigned tasks.
CE6: The student shows interest in the contents and the subject worked on.
CE7: The students demonstrate formal care, clarity and rigor in the exposition of ideas and reasoning.

GRADING TOOLS

The performance of the students will be assessed for their work, knowledge and skills acquired and the improvement of their learning process.
The continuous assessment instruments will consist of the fulfilment of continuous assessment activities proposed by the teacher for each of the topics.
The proposed activities, their contents and timing, will be communicated to the student during the presentation class or at the end of the corresponding content block. These activities comprise:

- PEI: Intermediate Assessment Tests (Pruebas de Evaluación Intermedia, PEI). During the course, several exams will be carried out, the content of which will focus on the topics covered or on expositions of group works. The contents and timing of these exams will be set during the first days of class
- PL: Lab Tests (Pruebas de Laboratorio, PL). These tests consist on expansions or variations of the practices carried out that must be resolved by the students.
- En: Deliverables (Entregable, En). An individual work and a group work will be delivered. The group work will be accompanied, in addition, by a work memory and it also will be presented in class.
- PEF: Final Assessment Test (Prueba de Evaluación Final, PEF). It consists of a written test, at the end of the teaching period, that requires the solving of a set of problems.

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
CB6, CB7, CGT1-CGT2, CT1, CT5	RA1, RA2	CE1	PEI1	20%
CB6, CB7, CGT1, CGT3	RA1, RA2	CE1,CE5,CE6	En1	10%
CB6, CB7, CGT3	RA1, RA2	CE2,CE5,CE6	En2	20%
CB6, CB7, CGT4-CGT5, CT1, CT2	RA3	CE3,CE4,CE6	PL1	20%
CB6, CB7, CGT1-CGT2, CGT5, CT1, CT2, CT5, CT6	RA1, RA2	CE6, CE7	PEF	30%

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
CB6, CB7, CGT1, CGT3	RA1, RA2	CE1,CE5,CE6	En1	10%
CB6, CB7, CGT3	RA1,RA2	CE2,CE5,CE6	En2	20%
CB6, CB7, CGT4-CGT5, CT1, CT2	RA3	CE3,CE4,CE6	PL1	20%
CB6, CB7, CGT1-CGT2, CGT5, CT1, CT2, CT5, CT6	RA1, RA2	CE6, CE7	PEF	50%

Extraordinary call

In the case of the extraordinary call, the same percentages that have been established in the case of the evaluation by means of a final exam will be maintained.

6. BIBLIOGRAPHY

6.1. Basic Bibliography

- Jens Eickhoff. Onboard Computers, Onboard Software and Satellite Operations: An Introduction. Springer (2016).
- Jane W. S. Liu. Real-Time Systems. Prentice Hall. 2000
- Hermann Kopetz. Real-Time Systems: Design Principles for Distributed Embedded Applications. Kluwer Academic Publishers, 1997.
- Giorgio Butazzo, Hard Real-Time Computing Systems, Kluwer Academic Publishers, 2005. Second edition.
- A. Burns and A. J. Wellings. Real-Time Systems and their Programming Languages. Addison-Wesley, 4th Edition. 2005.

6.2. Additional Bibliography

- H. Gomaa. Software Design Methods for Real-Time Systems. Addison-Wesley. 1993.
- Stankovic, J.A.: Misconceptions about Real--Time Computing - A Serious Problem for Next--Generation Systems. IEEE Computer, Vol. 21, No. 10, pp. 10--19, 1988.
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- Selic, Bran, Gulleckson, Garth, and Ward, Paul T. (1994), Real-Time Object Oriented Modelling. NewYork, John Wiley and Sons.
- Douglass, B P. Real Time UML. Advances in the UML for Real-Time Systems (3rd Edition). Addison Wesley, 2004.
- Douglass, B P. Doing Hard Time. Developing Real-Time Systems with UML, Objects, Frameworks, and Patterns. Addison Wesley, 1999.

Disclosure Note

The University of Alcalá guarantees to its students that, if due to health requirements the competent authorities do not allow the total or partial attendance of the teaching activities, the teaching plans will achieve their objectives through a teaching-learning and evaluation methodology in online format, which will return to the face-to-face mode as soon as these impediments cease.