1. BASIC INFORMATION

Subject	Satellite Design
Degree	Degree in Aerospace Engineering of Aircrafts
School	Escuela de Arquitectura, Ingeniería y Diseño
Course	4
ECTS	6 ECTS
Type	Compulsory
Language	English
Delivery method	In-person
Semester	First semester
Academic year	2019/2020
Coordinator	Julio Gallegos Alvarado

2. INTRODUCTION

"Satellite Design" is a compulsory subject in the study plan in the Degree of Aerospace Engineering in Aircrafts in the Department of Industrial and Aerospace Engineering at Universidad Europea de Madrid. The subject is part of the module "Aerospace Vehicles III".

The Satellite Design subject covers the following topics:

- Satellite engineering system and components: sensors, actuators and models
- Satellite application areas
- Attitude control
- Ground segment
- Mission analysis impact on satellite design.
- Satellite operations

3. COMPETENCIES AND LEARNING

Core competencies:

- CB1: That students have demonstrated knowledge and understanding in a field of study that part of the basis of general secondary education, and is usually found at a level that, while supported by advanced textbooks, includes some aspects that will knowledge of the forefront of their field of study.
- CB2. That students apply the acquired knowledge to the work in a professional and ethical way and to demonstrate competences by building and presenting solid arguments and the resolution of problems in the area of study.
- CB3. That students have the capacity to collect and interpret relevant data (normally inside their area of study) and provide their assessment considering on ethical, scientific and social matters.
- CB4. That students can communicate information, ideas, problems and solutions to an specialized and non-specialized audience.

Cross-curricular competences:

- CT1: Ability to perform design, development and management activities in the field of aeronautical engineering aimed, according to the knowledge acquired as provided in paragraph 5 of the Decree CIN/308/2009, to aerospace vehicles
- CT2: Planning, definition, direction and project management of design, stress analysis and production in the field of aeronautical engineering aimed, according to the knowledge acquired as provided in paragraph 5 of the Decree CIN/308/2009, to aerospace vehicles.
- CT3: Capacity to put knowledge into practice: using the knowledge acquired in the academic world in similar situations in the professional world.
- CT9: Problem solving: capacity to find the solution to complex situations that prevent the consecution to an objective
- CT11: Decision making: to be able to perform the selection among different alternatives and methods to solve problems in an effective way.
- CT15: Compile and interpret data to perform assessments that include relevant social, scientific and ethical aspects, considering fundamental rights as well as democratic principles, equity, solidarity, environmental protection, universal access, inclusive design and peace culture.
- CT17: Addressing the issues and challenges related to their area of expertise with flexibility, initiative, innovation, and dynamism (entrepreneurial profile).
- CT19: Working in interdisciplinary teams, providing the most efficient on the basis of cooperation, assuming their role within the team, establishing good relationships and exchanging information (Teamwork).

Specific competences:

- CE24: Adequate knowledge and applied to Engineering of: aircraft systems, and automatic flight control systems of aerospace vehicles
- CE25: Adequate knowledge and applied to Engineering of: Calculation methods Design and Program Management of aircraft; the use of experimental aerodynamics and the most significant parameters in the theoretical application; the management of experimental techniques, equipment and measuring instruments discipline; the simulation, design, analysis and interpretation of experimental and flight operations; the maintenance systems and certifications of aircraft.
- CE27**:** Ability to design satellites**.**

Learning Outcomes:

- LO20: To conduct studies by integrating the technologies and engineering procedures which are developed in the competencies of this modules
- LO21: From a series of requirements, and prior information, to conceptualize an engineering problem, proposes an approach to solve it, and obtain the better solution. All this related to the competencies of this module.

- LO22: To transfer some parts of an engineering problem to the laboratory, and utilize this resource as support to resolve
- LO30: Design any component in a Satellite

The table below shows the relationship between learning outcomes and competencies developed in the corresponding subject:

Competencies	Learning Outcomes
CT17, CE27	**RA31**
CB2, CB3, CB4, CT2, CT3, CT9, CT11, C24, C25	**RA20**
CB2, CB3, CB4, CT2, CT3, CT9, CT11, CT15, CT17, C24, C25, CE27	**RA21**
CB2, CB3, CB4, CT2, CT3, CT9, CT11, CT15, CT17, C24, C25, CE27	**RA22**

4. CONTENTS

The subject is organized in five learning units; each of which is subdivided into four or five areas depending on the unit:

Unit 1. Restrictions on design
Unit 2. Attitude control
Unit 3. On-board Computer
Unit 4. Ground segment and operation
Unit 5. Space components: sensors and actuators

5. TEACHING AND LEARNING METHODOLOGIES

The following lists the teaching and learning methodologies used in class:

- Lectures
- Use-case analysis
- Cooperative learning
- Problem based learning
- Project based learning

6. LEARNING ACTIVITIES

The following table shows the types of educational activities that will perform and the hours the student should use in each of them:

In-person:

Actividad formativa	Número de horas
Lectures	20
Team work	60
Tutoring sessions and written tests	20
Autonomous study	50
TOTAL	**150**

7. ASSESSMENT

Listed below is the assessment system used and the weight each one carries towards the final course grade:

Sistema de evaluación	Peso
Partial and final tests (15% each)	30%
Individual homework (4 along the course, 5% each)	20%
Progress reports	10%
Final project and presentation	40%

The details on the assessment activities are described in the course Campus Virtual, including due dates and the evaluation procedures for each one.

7.1. Ordinary evaluation period

To pass the class in the ordinary evaluation period it will be required to obtain a minimum of 5,0 out of 10,0 in the final grade (average of all activities).

Additionally, to pass the class all the criteria below shall be met:

- a score of 50% or above is required in each of the tests
- Delivery of at least 3 out of 4 homework and an average grade 50% or more.
- Deliver the project and final presentation on time and pass and obtain a grade of 50% or more.

7.2. Extraordinary evaluation period

To pass the class in the extraordinary evaluation period it will be required to obtain a minimum of 5,0 out of 10,0 in the final grade (average of all activities).

Those activities not passed during the ordinary period shall be delivered, this work will count up to a 50% towards the final grade in the extraordinary period. The remaining grade will be fulfilled with an individual project and a test, both will have to be passed with 50% or above individually.

8. CHRONOGRAM

The table shows the chronogram of activities including the due dates for all deliveries:

Topics	Dates
Restrictions on Design	Weeks 1 to 3
Attitude Control: dynamics	Weeks 4 and 5 HW 1
Attitude Control: passive systems	Week 6 HW 2
Attitude Control: active systems	Week 7 and 8 Mid-term exam
Attitude Control: simulation	Week 9 and 10
On-board computer	Week 11 and 12 HW 3
Operations	Week 13 and 14 HW 4
Sensors and actuators	Week 15
Satellite applications	Week 16
Final exam and final presentation	Week 17

The chronogram above may suffer modifications due to logistic reasons; any documentation will be notified to students through the usual channels with as much time in advance as possible.

9. BIBLIOGRAPHY

Literature used for the development of the class:

- Spacecraft Dynamics and Control, An introduction, Anthon H.J. De Ruiter, Christopher J. Damaren, James R. Forbes, Wiley 2013
- Space Mission Engineering, The New SMAD, Wertz, Everett, Puschell, Microcosm Press 2011
- Orbital Mechanics for Engineering Students, 3rd edition, Howard D. Curtis, Elsevier/BH, 2014
- Spacecraft Systems Engineering, 4th Edition, Peter Fortescue, Graham Swinerd, John Stark, Wiley 2011

The following is a list of recommended literature:

- Space Vehicle Design, 2nd Edition, Michael D. Griffin, James R. French, AIAA Education Series, 2004
- Spacecraft Dynamics & Control: A practical Engineering Approach, Marcel J. Sidi, Cambridge 2006 (reprint)
- Rocket Propulsion Elements, 7th Edition, George P. Sutton, Oscar Biblarz, John Wiley and Sons Inc., 2001
- Satellite Technology: Principles and Applications, 2nd Edition, Anil K. Maini, Varsha Agrawal, Wiley, 2011

10. DIVERSITY MANAGEMENT UNIT

Students with specific learning support needs:

Curricular adaptations and adjustments for students with specific learning support needs, in order to guarantee equal opportunities, will be overseen by the Diversity Management Unit (UAD: Unidad de Atención a la Diversidad).

It is compulsory for this Unit to issue a curricular adaptation/adjustment report, and therefore students with specific learning support needs should contact the Unit at unidad.diversidad@universidadeuropea.es at the beginning of each semester.