Course guide
230727 - CUBESAT - Cubesat-Based Mission Design and Testing

Last modified: 11/05/2022

Unit in charge: Barcelona School of Telecommunications Engineering
Teaching unit: 739 - TSC - Department of Signal Theory and Communications.

Degree: **Academic year:** 2022 **ECTS Credits:** 5.0
Languages: English

LECTURER

Coordinating lecturer: Adriano José CAMPS CARMONA (ETSETB)
Miquel SUREDA ANFRES (ESEIAAT)

Others: Adriano José CAMPS CARMONA (ETSETB)
Miquel SUREDA ANFRES (ESEIAAT)

PRIOR SKILLS

Basic knowledge of orbits and satellite subsystems. In case of not having them, it is recomended to study the following materials autonomously:
https://www.slideshare.net/adrianocamps/yp-in-space2018bcnallslidestheoryx2
https://www.slideshare.net/adrianocamps/yp-in-space2018bcnallslideslabsesssionsx2

TEACHING METHODOLOGY

Seminars and group work

LEARNING OBJECTIVES OF THE SUBJECT

Starting from a basic knowledge of the different subsystems of a satellite, it is intended to advance in the knowledge of the design of Earth observation missions and satellite-based communications, from the definition of mission requirements, system requirements, design, implementation and testing of the different subsystems of a picosatellite, and the traceability of the requirements.
To do this, the Valispace software will be used for concurrent design between different work teams, as well as other software tools such as Solid Works or Thermal desktop (mainly aerospace engineering students), Matlab, and other ad hoc calculations for orbits, coverage, etc.
The first half of the course will take place at ESEIAAT (Terrassa)
The second half of the course and the environmental tests will be carried out at the NanoSat Lab facilities of the ETSETBB (Barcelona, UPC Campus Nord).

STUDY LOAD

Type	Hours	Percentage
Hours large group	19,5	15.60
Hours small group	19,5	15.60
Self study	86,0	68.80

Total learning time: 125 h

CONTENTS

CUBESAT - CUBESAT-BASED MISSION DESIGN AND TESTING

Description:
• Introduction: The CubeSat standard. Systems engineering.
• Mission definition: From objectives to requirements.
• Mission architecture: Launch vehicles. Earth coverage. Simple delta-V budgets. Selecting orbits. Common Examples.
• Payload + Subsystems: Defining a payload and a platform.
• CubeSat Generative Design I: Introduction to generative design and CubeSat's
• CubeSat Generative Design II: Designing a frame for 3D printing.
• Understanding satellite's subsystems using the EyasSat.
• End-to-end Mission hardware in the loop simulation using BeeKit and BeeApp.
• Spacecraft Thermal analysis.
• Understanding the Attitude Determination and Control System (ADCS) using the Princeton Satellite Toolbox and EyaSat/Helmholtz coils.
• Satellite environmental testing: Thermal Vacuum Chamber and Shake Table.

Specific objectives:
Definition of system specifications
Collaborative and concurrent work
Tests and validation of requirements

Related activities:
Conduct environmental tests of nanosatellites (vacuum and thermal chamber, shake table), attitude tests, etc.

Full-or-part-time: 60h
Practical classes: 30h
Self study : 30h

GRADING SYSTEM

Continuous evaluation i final oral presentation, technical notes and test reports (see subject contents)

RESOURCES

Other resources:
https://www.cubesat.org/ />https://www.nasa.gov/content/cubesat-launch-initiative-resources