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

Unit in charge: Barcelona School of Telecommunications Engineering
Teaching unit: 739 - TSC - Department of Signal Theory and Communications.
Degree: MASTER'S DEGREE IN TELECOMMUNICATIONS ENGINEERING (Syllabus 2013). (Optional subject).
MASTER'S DEGREE IN ADVANCED TELECOMMUNICATION TECHNOLOGIES (Syllabus 2019). (Optional subject).
Academic year: 2020
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)

PRIORITY SKILLS
Basic knowledge of orbits and satellite subsystems. In case of not having them, it is recommended to study the following materials autonomously:
https://www.slideshare.net/adrianocamps/yp-in-space2018bcnallslidestheoryx2
https://www.slideshare.net/adrianocamps/yp-in-space2018bcnallslideslabsessionsx2

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

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
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<tbody>
<tr>
<td>Hours small group</td>
<td>19,5</td>
<td>15.60</td>
</tr>
<tr>
<td>Hours large group</td>
<td>19,5</td>
<td>15.60</td>
</tr>
<tr>
<td>Self study</td>
<td>86,0</td>
<td>68.80</td>
</tr>
</tbody>
</table>

Total learning time: 125 h
CONTENTS

CUBESAT - CUBESAT-BASED MISSION DESIGN AND TESTING

Description:
- Mission definition: From objectives to requirements.
- 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