CubeSat-based mission design and testing

This course aims to provide an advanced knowledge of nano-satellite mission design and testing, with particular emphasis on the CubeSat platform. It is offered to up to 10 students of ESEIAAT (Terrassa) who will enroll the subject "*CubeSat-based mission design and testing*", and to up to 10 students of ETSETB (Barcelona) who will enroll in one of the "*Introduction to Research*" modules.

The first lessons will be lectured at the ESEIAAT (Terrassa), addressing CubeSat mission design in detail. Therefore, all these lessons are developed in a workshop like format, with students distributed in groups of 4 to work in a group project.

The second half of the course will be lectured at the UPC NanoSat Lab (ETSETB, Campus Nord, Barcelona: https://nanosatlab.upc.edu/en), and will focus on different aspects of mission analysis and design, including thermal and mechanical design, mission analysis using hardware in the loop, simulating and experimenting attitude determination and control systems, and the use of the NanoSat Lab testing facilities for the environmental tests.

The course will be coordinated by Prof. Miquel Sureda, ESEIAAT (Terrassa), and Adriano Camps, ETSETB (Barcelona).

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Lessons ESEIAAT

Sessions 1 to 5 [Note: 11/03 is the Festa de Dia at the ETSETB]

1. 19/02 (8:00 to 12:00h)
   - Introduction: The CubeSat standard. Systems engineering.
   - Mission definition: From objectives to requirements.
2. 26/02 (8:00 to 12:00h)
   - Mission architecture: Launch vehicles. Earth coverage. Simple delta-V budgets. Selecting orbits. Common Examples.
3. 04/03 (8:00 to 12:00h)
   - Payload + Subsystems: Defining a payload and a platform.
4. 18/03 (8:00 to 12:00h)
   - CubeSat Generative Design I: Introduction to generative design and CubeSat's specifications.
5. 25/03 (8:00 to 12:00h)
   - CubeSat Generative Design II: Designing a frame for 3D printing.

Lab sessions at UPC CAMPUS NORD

Note: Due to limitations of the lab space available and limitation on number of EyasSat satellite kits, students will come 5 days out of 8 from 8 to 12 h, and on May 13 and 20 afternoon sessions (marked as [A]) will be opened from 16 to 20 h.

Sessions 6 to 10.

1. Understanding satellite's subsystems using the EyasSat.
2. End-to-end Mission hardware in the loop simulation using BeeKit and BeeApp.
3. Spacecraft Thermal analysis.
4. Understanding the Attitude Determination and Control System (ADCS) using the Princeton Satellite Toolbox and EyaSat/Helmholt coils.
5. Satellite environmental testing: Thermal Vacuum Chamber and Shake Table

Group	01/04	15/04	22/04	29/04	06/05	13/05	20/05	27/05
A	1	2	3	4	5			
B	2	3		5	1	4		
C	3		5		2		1	4
D		5	1	2	3		4 [A]	
E	5	1	2	3		4 [A]		

In addition to the theory and lab sessions, student personal work up to the total amount of credits will consist of assembling a picosatellite, and all the picosatellites will have to operate as a constellation.