Course guide
205205 - 205205 - Fundamentals of Cubesat Mission Design

Last modified: 22/04/2021

Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 758 - EPC - Department of Project and Construction Engineering.

Degree: **Academic year:** 2021 **ECTS Credits:** 3.0
Languages: English

LECTURER

Coordinating lecturer: Miquel Sureda

Others: David Gonzalez
Manel Soria
David de la Torre

PRIOR SKILLS

The student must have a good understanding of basic physics, mechanics, electronics and materials science.

TEACHING METHODOLOGY

The course aims to address the design of CubeSats both from the theoretical and the practical point of view. Therefore, lectures are divided into:

- Theory classes, in which lecturers explain the main principles of Cubesats design.
- Hands-on activities, where students obtain direct practical experience in certain aspects of CubeSats technology.
- Teamwork time, for students to develop their final group project.

LEARNING OBJECTIVES OF THE SUBJECT

The course aims to address the basics of artificial satellites design, with a special emphasis on the CubeSat platform and how the mission and the space environment itself affect its engineering.

STUDY LOAD

Type	Hours	Percentage
Hours large group	30,0	40.00
Self study	45,0	60.00

Total learning time: 75 h

CONTENTS

Basic Space Mission Design

Description:
Introduction: Mission and artificial satellites. Mission operations systems.
Basics of Orbit Design: The orbit design process. Two-body problem, Keplerian orbits and Hohmann transfer. Launch vehicles. Basic impulsive maneuvers.
Orbital Perturbations: Perturbation of the semi-major axis/orbital period, perturbation of the orbital plane and perturbation of the eccentricity vector.

Related activities:
- Theory lessons.
- Practical exercises.

Full-or-part-time: 23h
Theory classes: 10h
Self study : 13h

Anatomy of a CubeSat Mission

Description:
CubeSat Overview: Platform, applications and standards. A typical Cubesat mission.
Introduction to "qbapp" and "qbkit".

Related activities:
- Theory lessons.
- Practical exercises.
- Group project (work in progress).

Full-or-part-time: 26h
Theory classes: 10h
Self study : 16h

Basic Subsystems Design

Description:
- Structural Design: Frameworks and structures, loads and stiffness, materials selection, structural analysis.
- Thermal Design: Thermal sources and transport mechanisms in space, thermal balance.
- Power Systems Design: Power generation, storage, regulation and monitoring.
- Comms and Data Handling Design: Tracking, telemetry and command systems. RF link, data handling, OBCs.
- Guidance, Navigation and ADCS Systems: Orbit determination and control. Attitude determination.

Related activities:
- Theory lessons.
- Practical exercises.
- Group project (work in progress).

Full-or-part-time: 26h
Theory classes: 10h
Self study : 16h

GRADING SYSTEM

The course will be graded based on:

- Individual exercises: 50%
- Final group project: 50%

Any student who wishes to improve his grade may try it at the exam planned at the end of the course. The best mark is preserved.

BIBLIOGRAPHY

Basic:

- Wertz, J.R.; Larson, W.J. Space mission analysis and design. 3rd ed. Dordrecht: Kluwer Academic, cop. 1999. ISBN 9781881883104.

RESOURCES

Other resources:

Due to the characteristics of this course, relevant web-based material and scientific publications are a very important source of information.