

## Course guide

### 205091 - 205091 - Cubesat Based Mission Design and Testing

**Last modified:** 19/04/2023

**Unit in charge:** Terrassa School of Industrial, Aerospace and Audiovisual Engineering  
**Teaching unit:** 205 - ESEIAAT - Terrassa School of Industrial, Aerospace and Audiovisual Engineering.  
**Degree:** MASTER'S DEGREE IN AERONAUTICAL ENGINEERING (Syllabus 2014). (Optional subject).  
MASTER'S DEGREE IN SPACE AND AERONAUTICAL ENGINEERING (Syllabus 2016). (Optional subject).

**Academic year:** 2023    **ECTS Credits:** 6.0    **Languages:** English

#### LECTURER

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**Coordinating lecturer:** Sureda Anfres, Miquel  
**Others:** Gutierrez Cabello, Jorge Luis

#### PRIOR SKILLS

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The student must have a good understanding of programming, mechanics (rigid-body dynamics), basics spacecraft design and orbital mechanics (two-body problem, Keplerian orbits, Hohmann transfer, basic impulsive maneuvers, launch geometry).

#### TEACHING METHODOLOGY

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All sessions will be developed in a workshop format, with students distributed in groups to work on small projects.

#### LEARNING OBJECTIVES OF THE SUBJECT

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This course aims to provide an advanced knowledge of nano-satellite mission and subsystems design, with particular emphasis on the CubeSat platform.

#### STUDY LOAD

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Type	Hours	Percentage
Hours large group	54,0	36.00
Self study	96,0	64.00

**Total learning time:** 150 h

## CONTENTS

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### 1. Introduction

**Description:**

1. Introduction: The CubeSat standard. Systems engineering.
2. Mission definition: From objectives to requirements.

**Related activities:**

- Theory lessons.
- Workshop.

**Full-or-part-time:** 12h

Theory classes: 4h

Self study : 8h

### 2. Mission Architecture I

**Description:**

1. Launch vehicles.
2. Constellations & coverage.
3. Simple delta-V budgets. Selecting orbits.
4. Common Examples.

**Related activities:**

- Theory lessons.
- Workshop.

**Full-or-part-time:** 12h

Theory classes: 4h

Self study : 8h

### 3. Mission Architecture II

**Description:**

1. Payload + Subsystems: Defining a platform.

**Related activities:**

- Theory lessons.
- Workshop.

**Full-or-part-time:** 12h

Theory classes: 4h

Self study : 8h

#### 4. 3D printing

**Description:**

1. Introduction to 3D printing.
2. Design and implementation.

**Related activities:**

- Theory lessons.
- Workshop.

**Full-or-part-time:** 24h

Theory classes: 8h

Self study : 16h

#### 5. IAM 3D Hub visit

**Description:**

1. IAM 3D Hub facilities visit.

**Related activities:**

- Workshop.

**Full-or-part-time:** 11h

Theory classes: 5h

Self study : 6h

#### 6. ADCS

**Description:**

1. External perturbations.
2. Attitude determination.
3. Attitude control.
4. Scanning law.
5. Laboratory work.

**Related activities:**

- Theory lessons.
- Workshop.

**Full-or-part-time:** 60h

Theory classes: 20h

Self study : 40h

## 7. Communications

### Description:

1. Introduction ground stations.
2. Introduction SDR and GNU radio.
3. Observations of the Sun.
4. Analysis of local RFI.
5. Real telemetry analysis.
6. Contact some PocketQube.
7. Friis equation in detail.

### Related activities:

- Theory lessons.
- Workshop.

### Full-or-part-time: 15h

Theory classes: 7h

Self study : 8h

## 8. NanoSat Lab visit

### Description:

1. NanoSat Lab visit at UPC Campus Nord.

### Related activities:

- Workshop.

### Full-or-part-time: 4h

Theory classes: 2h

Self study : 2h

## GRADING SYSTEM

The course will be evaluated with:

- Project 1: 40%
- Project 2: 40%
- Theoretical test: 20%

## BIBLIOGRAPHY

### Basic:

- Wertz, James R.; Larson Wiley J. Space mission analysis and design. 3rd ed. Dordrecht [etc.]: Kluwer Academic, 1999. ISBN 9781881883104.
- Fortescue, Peter W.; Stark, John P. W.; Swinerd, Graham. Spacecraft systems engineering [on line]. 4th ed. Chichester ; New York: Wiley, cop. 2011 [Consultation: 03/05/2022]. Available on: <https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=693314>. ISBN 9780470750124.

## RESOURCES

### Other resources:

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