205067 - Advanced Cubesat Mission Design

Coordinating unit: 205 - ESEIAAT - Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 205 - ESEIAAT - Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Academic year: 2019
Degree: MASTER'S DEGREE IN SPACE AND AERONAUTICAL ENGINEERING (Syllabus 2016). (Teaching unit Optional)
MASTER'S DEGREE IN AERONAUTICAL ENGINEERING (Syllabus 2014). (Teaching unit Optional)
ECTS credits: 3
Teaching languages: English

Teaching staff
Coordinator: Miquel Sureda
Others: David González
Manel Soria
David de la Torre

Opening hours
Timetable: To be defined.

Prior skills
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
The course aims to address the design and construction of CubeSats in detail. Therefore, almost all the lessons are developed in a workshop like format, with students distributed in groups to work in a group project.

Learning objectives of the subject
This course aims to give advanced knowledge of nano-satellites design, with particular emphasis on the design process and construction of CubeSats. As final outcome of the course, each group will define a CubeSat mission and will build and test its payload.

Study load

<table>
<thead>
<tr>
<th>Total learning time: 75h</th>
<th>Hours large group: 27h 36.00%</th>
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<tbody>
<tr>
<td></td>
<td>Hours medium group: 0h 0.00%</td>
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<td></td>
<td>Hours small group: 0h 0.00%</td>
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<td></td>
<td>Guided activities: 0h 0.00%</td>
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<tr>
<td></td>
<td>Self study: 48h 64.00%</td>
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## Content

### Advanced CubeSat Mission Design

<table>
<thead>
<tr>
<th>Learning time: 12h</th>
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<tbody>
<tr>
<td>Theory classes: 4h</td>
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<tr>
<td>Self study : 8h</td>
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**Description:**
Selecting orbits. Common Examples.

**Related activities:**
Theory lessons.

### CubeSat Mission Definition

<table>
<thead>
<tr>
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<tr>
<td>Theory classes: 4h</td>
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<tr>
<td>Self study : 8h</td>
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**Description:**
Mission Concept: Defining a payload and a CubeSat platform.
Mission Timeline: Design, production, test campaigns, launch, deployment and operations.

**Related activities:**
- Theory lessons.
- Workshop.

### Advanced Subsystems Design

<table>
<thead>
<tr>
<th>Learning time: 30h</th>
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<tr>
<td>Theory classes: 15h</td>
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<tr>
<td>Self study : 15h</td>
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**Description:**
- Mechanical Design: Frameworks and structures, stress analysis, loads and stiffness, elastic instabilities, vibration, materials selection, structural analysis.
- Thermal Design: Thermal sources and transport mechanisms in space, thermal balance, thermal control elements, thermal design and implementation.
- Comms and Data Handling Design: Tracking, telemetry and command systems. RF link, data handling, OBCs.

**Related activities:**
- Theory lessons.
- Workshop.
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<table>
<thead>
<tr>
<th>Payload Design</th>
<th>Learning time: 21h</th>
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<tbody>
<tr>
<td></td>
<td>Theory classes: 4h</td>
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<td></td>
<td>Self study: 17h</td>
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**Description:**
Payload Design Production and Testing: Detailed design, production, ambient test campaign, environmental test campaign, Payload Delivery.

**Related activities:**
- Theory lessons.
- Workshop.

**Qualification system**

The course will be graded based on:

- Individual exercises: 30%
- Final group project: 70%

In case of being unable to hand the individual exercises or not passing them, the student will have a second opportunity.

**Bibliography**

**Basic:**


**Complementary:**

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