220333 - Spacecraft Design

Coordinating unit: 205 - ESEIAAT - Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 220 - ETSEIAT - Terrassa School of Industrial and Aeronautical Engineering
Academic year: 2019
Degree: MASTER’S DEGREE IN AERONAUTICAL ENGINEERING (Syllabus 2014). (Teaching unit Optional)
MASTER’S DEGREE IN SPACE AND AERONAUTICAL ENGINEERING (Syllabus 2016). (Teaching unit Optional)
ECTS credits: 5
Teaching languages: English

Teaching staff
Coordinator: Miquel Sureda

Opening hours

Timetable:

Prior skills
Basic space engineering knowledge (Subject 220057 - Space Engineering)

Teaching methodology
The main objective of this course is to provide the required knowledge and ressources to design a space mission. A series of lectures will introduce the different aspects involved in a space mission design. The student will apply this knowledge and ressources to carry out an assignment and a project, with guidance and supervision during the whole semester.

A mid-term and final exam will test the knowledge acquired during the semester.

Learning objectives of the subject
Ability to analyze and design a space mission:

This subject will provide the student basic knowledge on Systems Engineering and Mission Analysis, as well as the required knowledge and ressources to design a space vehicle, including the payload and the following subsystems:

* Structures
* Electrical Power System
* Attitude Control
* Communication
* Navigation
* Propulsion
* Environmental Control and Life Support System
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## Study Load

<table>
<thead>
<tr>
<th></th>
<th>Hours large group:</th>
<th>Hours small group:</th>
<th>Self study:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total learning time:</strong> 125h</td>
<td>30h</td>
<td>15h</td>
<td>80h</td>
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<tr>
<td></td>
<td>24.00%</td>
<td>12.00%</td>
<td>64.00%</td>
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## Introduction

<table>
<thead>
<tr>
<th>Learning time: 5h</th>
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<tbody>
<tr>
<td>Theory classes: 2h</td>
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<tr>
<td>Self study: 3h</td>
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**Description:**

Introduction to the course.
Past, present and future of space missions: history of space missions, which missions are currently being carried out?, which are the future objectives of space agencies and private companies?

**Related activities:**
Mid-term Exam

## Systems Engineering

<table>
<thead>
<tr>
<th>Learning time: 12h</th>
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<tbody>
<tr>
<td>Theory classes: 4h</td>
</tr>
<tr>
<td>Laboratory classes: 2h</td>
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<tr>
<td>Self study: 6h</td>
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**Description:**

Introduction to Systems Engineering: what are the phases of a project? What is concurrent engineering? How can the cost of a mission be estimated?
Mission Concept Design: Definition of concepts such as mission statement, objectives, requirements and constrains.

**Related activities:**
Assignment
Mid-Term Exam

## Mission Analysis and Characterization

<table>
<thead>
<tr>
<th>Learning time: 41h</th>
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<tbody>
<tr>
<td>Theory classes: 6h</td>
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<tr>
<td>Laboratory classes: 5h</td>
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<tr>
<td>Self study: 30h</td>
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</tbody>
</table>

**Description:**

Review of orbital mechanics.
Identification of alternative mission concepts and architectures.
Preliminary concepts and trade-offs.

**Related activities:**
Project (Part 1: Mission Analysis and Characterization)
Mid-term Exam
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## Spacecraft Subsystems

<table>
<thead>
<tr>
<th>Description: Review of Subsystems:</th>
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<tbody>
<tr>
<td>* electric power</td>
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<tr>
<td>* thermal control</td>
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<tr>
<td>* structures</td>
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</tbody>
</table>

Definition, design process and technology options for each subsystem:

* propulsion
* attitude and orbit determination and control
* communication and data handling
* environmental control and life support
* payload
* launchers

## Related activities:

Project (Part 2: Preliminary Design)
Final Exam

## Qualification system

Final Grade = Assignment (10%) + Project (60%) + Final Exam (30%)

In case of being unable to hand the assignments or not passing them, the student will have a second opportunity for the day of the final exam.

For those students who meet the requirements and submit to the reevaluation examination, the grade of the reevaluation exam will replace the grades of all the on-site written evaluation acts (tests, midterm and final exams) and the grades obtained during the course for lab practices, works, projects and presentations will be kept.

If the final grade after reevaluation is lower than 5.0, it will replace the initial one only if it is higher. If the final grade after reevaluation is greater or equal to 5.0, the final grade of the subject will be pass 5.0.
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Bibliography

Basic:


Complementary: