205203 - Introduction to Rockets

Coordinating unit: 205 - ESEIAAT - Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 748 - FIS - Department of Physics
Academic year: 2019
Degree:
- BACHELOR'S DEGREE IN INDUSTRIAL TECHNOLOGY ENGINEERING (Syllabus 2010). (Teaching unit Optional)
- BACHELOR'S DEGREE IN AEROSPACE TECHNOLOGY ENGINEERING (Syllabus 2010). (Teaching unit Optional)
- BACHELOR'S DEGREE IN AEROSPACE VEHICLE ENGINEERING (Syllabus 2010). (Teaching unit Optional)
ECTS credits: 3
Teaching languages: English

Teaching staff
Coordinator: Manel Soria
Arnau Miró

Teaching methodology
The course will be developed through theoretical lectures, hands-on sessions with simulation software (ready available and to be developed by the students) and laboratory sessions, where the students will develop their own instrumentation to test small scale rockets and rocket engines.

Learning objectives of the subject
Be familiar with rockets and their historic importance.
Know and understand the basic rocket components.
Understand the fundamentals of rocket propulsion and the different engine types.
Understand the thermodynamics of rocket engines.
Understand how rocket trajectories can be simulated.
Be familiar with rocket test bench instrumentation.

Study load

<table>
<thead>
<tr>
<th>Total learning time: 75h</th>
<th>Hours large group: 30h</th>
<th>40.00%</th>
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<tbody>
<tr>
<td></td>
<td>Hours medium group: 0h</td>
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<tr>
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<td>Hours small group: 0h</td>
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<td>Guided activities: 0h</td>
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<td>Self study: 45h</td>
<td>60.00%</td>
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### Content

<table>
<thead>
<tr>
<th>Module 1: Fundamentals of rockets</th>
<th>Learning time: 25h</th>
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<tbody>
<tr>
<td></td>
<td>Theory classes: 10h</td>
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<tr>
<td></td>
<td>Self study : 15h</td>
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**Description:**
- History
- Main rocket components components
- Multiple stage rockets
- Case study: SpaceX
- Thermodynamics of rocket engines

<table>
<thead>
<tr>
<th>Module 2: Rocket trajectories</th>
<th>Learning time: 25h</th>
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<tr>
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<td>Theory classes: 10h</td>
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<tr>
<td></td>
<td>Self study : 15h</td>
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**Description:**
- Study of basic rocket launch maneouvers with Kerbal Space simulator.
- Two-dimensional model of rocket launch.

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<tr>
<th>Module 3: Experimental testing of rockets and rocket engines.</th>
<th>Learning time: 25h</th>
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<td>Theory classes: 10h</td>
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<td></td>
<td>Self study : 15h</td>
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</tbody>
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**Description:**
- Test bench and rocket instrumentation: load cells, data loggers, GPS, IMU
- Rocket telemetry systems
- Hands on session: test of a rocket engine
- Hands on session: launch and recovery of a rocket with data loggers and/or telemetry sytems

### Qualification system

Class participation and class exercises: 30%
Assignment: 30%
Project: 40%

Students with a grade below 5.0 in the project, or the assignments, or the classroom participation, will be able to take an additional written exam covering all the subject, that will take place the date fixed in the calendar of final exams. The grade obtained in this test will range between 0 and 10, and will replace that of the part or parts below 5.0 only in case it is higher, up to a maximum of 5.0 points.

### Bibliography