220343 - Advanced Propulsion

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: 2018
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: Manel Soria Guerrero
Josep Oriol Lizandra Dalmases

Prior skills
Previous concepts include knowledge of propulsion systems for aircraft and spacecraft, given in any bachelor?s degree in aerospace engineering and reviewed in previous subjects of this Master?s degree, as well as familiarity with the use of computing tools for engineering.

Degree competences to which the subject contributes

Specific:
CEEPROP1. MUEA/MASE: Sufficient applied knowledge of aspects of measurement, calculation and numerical resolution in experimental and computational aerodynamics (specific competency for the specialisation in Propulsion).
CEEPROP2. MUEA/MASE: Advanced applied knowledge of the design, manufacture and maintenance of propulsion systems (specific competency for the specialisation in Propulsion).

Teaching methodology
Classroom lectures combined with assignments to be solved during the class with the help of the professor

Learning objectives of the subject

- Understand the fundamental principles and the limitations of the advanced propulsion technologies.
- Understand the key practical issues associated with the testing of new propulsion and energy storage devices.
- Have an adequate knowledge of the current state of electric propulsion for manned and unmanned aircraft, its potential and limitations.
- Understand mini satellites propulsion systems, their potential and limitations.

Study load

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

<table>
<thead>
<tr>
<th>Module 1: Introduction. Technological forecasting applied to advanced propulsion concepts</th>
<th>Learning time: 40h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 10h</td>
<td>Practical classes: 5h</td>
</tr>
<tr>
<td>Self study : 25h</td>
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</tbody>
</table>

### Description:
- content english

<table>
<thead>
<tr>
<th>Module 2: Advanced aircraft propulsion</th>
<th>Learning time: 40h</th>
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</thead>
<tbody>
<tr>
<td>Theory classes: 10h</td>
<td>Practical classes: 5h</td>
</tr>
<tr>
<td>Self study : 25h</td>
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</tbody>
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### Description:
- Energy storage: technologies, capacity, charge/discharge rates, safety
- Brushless engines
- New propeller concepts
- Propeller testing
- Propulsion for small, medium and large scale UAVs
- Case study: manned and unmanned aircraft with electric propulsion
- Case study: perpetually flying machines
- Hands-on work

<table>
<thead>
<tr>
<th>Module 3: Advanced spacecraft propulsion</th>
<th>Learning time: 45h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 10h</td>
<td>Practical classes: 5h</td>
</tr>
<tr>
<td>Self study : 30h</td>
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</tbody>
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### Description:
- Propulsion for miniature satellites (microsatellites and nanosatellites)
- Design for safety
- Case study: water hydrolysis rocket propulsion
- Case study: solar sails
- Hands-on work
Qualification system

Assignments 30%
Project 40%
Exam 30%

Students with a grade below 5.0 in the project and/or assignments, will be able to do an additional exam in order to compensate for the poor results. The new grade will replace the original only if it is higher. The maximum grade that can be obtained with this additional exam is 5.0.

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.

Bibliography

Basic:


