Last update: 05-10-2018

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

Total learning time: 125h	Hours large group:	30h	24.00%
	Hours small group:	15h	12.00%
	Self study:	80h	64.00%

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Content

Module 1: Introduction. Technological forecasting applied to advanced propulsion concepts

Learning time: 40h

Theory classes: 10h
Practical classes: 5h
Self study : 25h

Description:
content english

Module 2: Advanced aircraft propulsion

Learning time: 40h

Theory classes: 10h
Practical classes: 5h
Self study : 25h

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

Module 3: Advanced spacecraft propulsion

Learning time: 45h

Theory classes: 10h
Practical classes: 5h
Self study : 30h

Description:
Propulsion for miniature satellites (microsatellites and nanosatellites)
Design for safety
Case study: water hydrolysis rocket propulsion
Case study: solar sails
Hands-on work

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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:

Datta, L.V.; Guven, U. Introduction to nanosatellite technology and components: applications of cubesat technology. Saarbrücken: Lap Lambert Academic Pub, 2012. ISBN 9783847314196.

Horowitz, P.; Hill, W. The art of electronics. 3rd ed. New York: Cambridge University Press, 2015. ISBN 9780521809269.

Saravanamuttoo, H. I. H. [et al.]. Gas turbine theory. 6th ed. Harlow, England; New York: Pearson Prentice Hall, cop. 2009. ISBN 9780132224376.

Venkatesh, B. J. Design and performance evaluation of a propeller: design and performance evaluation of a propeller for micro-air vehicle application. Saarbrücken: Lap Lambert Academic Pub, 2012. ISBN 9783847370116.

Dixon, S.L.; Hall, C.A. Fluid mechanics and thermodynamics of turbomachinery. 7th ed. Butterworth-Heinemann, 2013. ISBN 9780124159549.

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