

300311 - MRW - Model Rocket Workshop

Coordinating unit:	300 - EETAC - Castelldefels School of Telecommunications and Aerospace Engineering		
Teaching unit:	748 - FIS - Department of Physics		
Academic year:	2016		
Degree:	BACHELOR'S DEGREE IN AIR NAVIGATION ENGINEERING (Syllabus 2010). (Teaching unit Optional) BACHELOR'S DEGREE IN AIRPORT ENGINEERING (Syllabus 2010). (Teaching unit Optional) BACHELOR'S DEGREE IN AEROSPACE SYSTEMS ENGINEERING (Syllabus 2015). (Teaching unit Optional)		
ECTS credits:	3	Teaching languages:	English

Teaching staff

Coordinator:	José Ignacio Rojas Gregorio
Others:	Santiago Torres Gil, Enrique García-Berro Montilla, José Ignacio Rojas Gregorio

Opening hours

Timetable:	to be arranged via email
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Prior skills

Mechanics, Fluid Dynamics, Propulsion, Thermodynamics, differential equations, MATLAB, Octave and/or Maple

Requirements

Ampliació de Matemàtiques, Mechanics, Fluid Dynamics, Thermodynamics, Informatics 2 and Aerodynamics & Flight Mechanics

Degree competences to which the subject contributes

Generical:

- 02 GPR N3. PROJECT MANAGEMENT - Level 3: Define the objectives of an extensive project and open, multidisciplinary. Schedule tasks and resources, track and integration of the parties. To evaluate the intermediate and final results, restating the objectives if necessary.
- 01 UEQ N1. EFFICIENT USE OF EQUIPMENT AND INSTRUMENTS - Level 1: Using instruments, equipment and software from the laboratories of general or basic use. Realising experiments and proposed practices and analyzing obtained results.
- 02 GPR N2. PROJECT MANAGEMENT - Level 2: Define the objectives of a well-defined, narrow scope, and plan development, identifying resources, tasks, shared responsibilities and integration. Use appropriate tools to support project management.
- 02 GPR N1. PROJECT MANAGEMENT - Level 1: To know project management tools carrying out the different phases of the project established by the professor

Transversal:

- 07 AAT N1. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.
- 04 COE N3. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 3. Communicating clearly and efficiently in oral and written presentations. Adapting to audiences and communication aims by using suitable strategies and means.
- 05 TEQ N3. TEAMWORK - Level 3. Managing and making work groups effective. Resolving possible conflicts, valuing working with others, assessing the effectiveness of a team and presenting the final results.
- 05 TEQ N1. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.

300311 - MRW - Model Rocket Workshop

03 TLG. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.

01 EIN N1. ENTREPRENEURSHIP AND INNOVATION - Level 1. Showing enterprise, acquiring basic knowledge about organizations and becoming familiar with the tools and techniques for generating ideas and managing organizations that make it possible to solve known problems and create opportunities.

04 COE N2. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 2. Using strategies for preparing and giving oral presentations. Writing texts and documents whose content is coherent, well structured and free of spelling and grammatical errors.

05 TEQ N2. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.

07 AAT N3. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

07 AAT N2. SELF-DIRECTED LEARNING - Level 2: Completing set tasks based on the guidelines set by lecturers. Devoting the time needed to complete each task, including personal contributions and expanding on the recommended information sources.

Teaching methodology

? MRW is based on self-learning and project-based learning, with orientation and guidance provided by the faculty.

? Activities will be realized basically in laboratory C4-SA-1V, but some tasks may be realized as homework.

? The student will work in teams to build the rocket and elaborate a report.

Learning objectives of the subject

At the end of the MRW, the students must be able of:

? Identifying and defining basic concepts of rocketry and model rocketry

? Realize simulations and computations of the rocket trajectory based on the rocketry equation

Study load

Total learning time: 75h	Hours large group:	0h	0.00%
	Hours medium group:	0h	0.00%
	Hours small group:	33h	44.00%
	Guided activities:	0h	0.00%
	Self study:	42h	56.00%

300311 - MRW - Model Rocket Workshop

Content

Model Rocket Workshop

Learning time: 75h

Laboratory classes: 33h

Self study : 42h

Description:

- Introduction
- Conceptos básicos de coherería y coherería de modelismo
- Formación de grupos y repartición de roles: ingeniero de misión, responsable de calidad y certificación, ingeniero de lanzamiento, etc.
- Diseño CAD de cohete de modelismo
- Construcción de dos cohetes de modelismo: uno con madera y cartón como materiales principales y otro con impresora 3D
- Simulación de la trayectoria de los cohetes de modelismo
- Certificación de los cohetes de modelismo
- Lanzamiento de los cohetes de modelismo
- Comparación de la trayectoria real con la trayectoria obtenida de las simulaciones
- Elaboración del informe final y presentación final del trabajo realizado

Nota: Los contenidos de la asignatura, su funcionamiento y la metodología, así como otros aspectos generales están descritos en las referencias siguientes:

Rojas, J.I., et al., Model Rocket Workshop: a Problem-Based Learning experience for engineering students, *International Journal of Emerging Technologies in Learning*, 3(4) (2008) 70-77: <http://hdl.handle.net/2117/2383>

Rojas, J.I., et al., Chapter 17: Effectiveness of Problem Based Learning for Engineering Curriculum, *Cases on Technological Adaptability & Transnational Learning: Issues & Challenges* (ISBN: 978-1-616-92289-4), IGI Global, Hershey, Pennsylvania (USA), 2010, pp. 333-359. Available online: <http://hdl.handle.net/2117/7832>

In the document [CSB-MRW-GD-10-guidelines.pdf](#), you can find a very detailed description of each of the activities and tasks associated with the MRW, of great utility for the students.

Related activities:

Guided activities:

- o Kick-off session, initial guidance
- o Assistance for rocket construction
- o Guidance for correct certification of the rocket
- o Guidance for correct launching of the rocket
- o Assessment of the final report

Rated activities:

- o Final report

Specific objectives:

Se pretenden evaluar las siguientes competencias:

- o Específicas: coherería
- o Genéricas: trabajo en grupo, autoaprendizaje

300311 - MRW - Model Rocket Workshop

Qualification system

Final mark for MRW (over 10), CF, is obtained this way:

$$CF = IF$$

where: IF: mark for final report 100%

Regulations for carrying out activities

? For realizing the corresponding activities it is necessary to have the suitable material previously indicated by the faculty or suggested by the students.

? The due dates for delivering the corresponding reports will be notified at the beginning of the course. Delays in the deliveries will penalize the global mark.

Bibliography

Basic:

Fortescue, Peter W.; Stark, John P. W.; Swinerd, Graham. Spacecraft systems engineering [on line]. 3rd ed. Chichester ; New York: Wiley, 2003 Available on:
<<http://site.ebrary.com/lib/upcatalunya/docDetail.action?docID=10494538&p00=spacecraft%20systems%20engineering>>. ISBN 9780471619512.

Tajmar, Martin. Advanced space propulsion systems. New York: Springer, 2003. ISBN 3211838627.

Sutton, George P.; Biblarz, Oscar. Rocket propulsion elements. 7th ed. New York: John Wiley & Sons, 2001. ISBN 0471326429.