300321 - UAS-OA - Unmanned Aircraft Systems

Coordinating unit: 300 - EETAC - Castelldelfels School of Telecommunications and Aerospace Engineering
Teaching unit: 701 - DAC - Department of Computer Architecture
748 - FIS - Department of Physics

Academic year: 2019
Degree: BACHELOR'S DEGREE IN AIRPORT ENGINEERING (Syllabus 2010). (Teaching unit Optional)
BACHELOR'S DEGREE IN AIR NAVIGATION ENGINEERING (Syllabus 2010). (Teaching unit Optional)
BACHELOR'S DEGREE IN AEROSPACE SYSTEMS ENGINEERING (Syllabus 2015). (Teaching unit Optional)

ECTS credits: 6
Teaching languages: Catalan, Spanish, English

Teaching staff

Coordinator: Definit a la infoweb de l'assignatura.
Others: Definit a la infoweb de l'assignatura.

Opening hours

Timetable: Defined to the subject infoweb.

Prior skills
- To know basics of OOP.
- Learn to program in a programming language.
- Programming in Matlab.

Requirements
- Computer Science II

Degree competences to which the subject contributes

Specific:
1. CE 9 AERO. Comprender la globalidad del sistema de navegación aérea y la complejidad del tráfico aéreo.
   (CIN/308/2009, BOE 18.2.2009)
7. CE 1 AERO. Capacidad para la resolución de los problemas matemáticos que puedan plantearse en la ingeniería.
   Aptitud para aplicar los conocimientos sobre: álgebra lineal; geometría; geometría diferencial; cálculo diferencial e
   integral; ecuaciones diferenciales y en derivadas parciales; métodos numéricos; algorítmica numérica; estadística y
   optimización. (CIN/308/2009, BOE 18.2.2009)
8. CE 14 AERO. Comprender el sistema de transporte aéreo y la coordinación con otros modos de transporte.
   (CIN/308/2009, BOE 18.2.2009)

Transversal:
4. 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.
14. 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.
11. 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.
10. 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.
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Teaching methodology

The course combines the following teaching methods:

- Third language, because the course materials will be in English.
- Self study, because students will work self-learning materials at home.
- Cooperative learning, because students are organized in small groups to perform some course tasks.
- Project-based learning, because students will develop a project in groups during the course.
- Class presentations by teachers.

Learning objectives of the subject

At the end of the unmanned systems course the student should be able to:

- Explain the terminology specific to unmanned aerial systems.
- Identify and describe the parts that compose an unmanned aerial system, their uses and applications, as well as explain the historical evolution of them.
- Use simulation environments for unmanned aerial systems.
- Use existing flight control stations for unmanned aerial systems.
- Interact with an autopilot of an unmanned aerial system and acquire flight telemetry data.
- Explain the existing Spanish (AESA) and European (EC/EASA) regulations for unmanned aerial systems.
- Describe the regulations regarding the safety of operations with unmanned aerial systems.
- Explain the existing and future processes for the integration of unmanned aerial systems in low level air space (Very Low Level (VLL)).
- Explain the existing and future processes for the integration of unmanned aerial systems in unsegregated airspace.

Study load

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group: 32h 30m</th>
<th>21.67%</th>
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<tbody>
<tr>
<td></td>
<td>Hours small group: 33h 30m</td>
<td>22.33%</td>
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<td></td>
<td>Self study: 84h</td>
<td>56.00%</td>
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</table>
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## Content

<table>
<thead>
<tr>
<th>(ENG) - Introduction to Unmanned Aircraft Systems (UAS)</th>
<th>Learning time: 53h 20m</th>
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</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Theory classes: 10h</td>
</tr>
<tr>
<td>1.1 Historical Evolution</td>
<td>Laboratory classes: 13h 20m</td>
</tr>
<tr>
<td>1.2 Definition (UAS vs RPAS)</td>
<td>Self study : 30h</td>
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<tr>
<td>1.3 UAS Components</td>
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<td>1.4 UAS Uses and Applications</td>
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<td>1.5 Current Situation</td>
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<td>1.6 UAS Autopilot</td>
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<td>1.7 UAS Flight Plan and Mission Management.</td>
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<td>1.8 UAS Ground Control Stations (GCS)</td>
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<td>1.9 Simulation Environment</td>
<td></td>
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<tr>
<td><strong>Related activities:</strong></td>
<td></td>
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<tr>
<td>A1, E1 and E2</td>
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<table>
<thead>
<tr>
<th>(ENG) - Spanish and European regulation of unmanned aerial systems</th>
<th>Learning time: 15h</th>
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Theory classes: 6h</td>
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<tr>
<td>2.1 Spanish standards and regulations</td>
<td>Self study : 9h</td>
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<tr>
<td>2.2 European standards and regulations</td>
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<tr>
<td>2.3 Operational scenarios</td>
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<tr>
<td><strong>Related activities:</strong></td>
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<tr>
<td>E1 and E2</td>
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<table>
<thead>
<tr>
<th>(ENG) - Safety in unmanned aerial systems operations</th>
<th>Learning time: 28h 10m</th>
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Theory classes: 6h 30m</td>
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<tr>
<td>3.1 General safety aspects</td>
<td>Laboratory classes: 6h 40m</td>
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<tr>
<td>3.2 Risk assessment for specific operations</td>
<td>Self study : 15h</td>
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<tr>
<td><strong>Related activities:</strong></td>
<td></td>
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<tr>
<td>A1, E1 and E2</td>
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</table>
### (ENG) - UAS Integration in non segregated airspace.

**Learning time:** 53h 30m  
- Theory classes: 10h  
- Laboratory classes: 13h 30m  
- Self study: 30h

<table>
<thead>
<tr>
<th>Description:</th>
<th>Related activities:</th>
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</thead>
<tbody>
<tr>
<td>4.1 Airspace management for low-level operations</td>
<td>A1, E1 and E2</td>
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<tr>
<td>4.2 Airspace management for non-segregated operations</td>
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**Related activities:**

A1, E1 and E2
### Planning of activities

<table>
<thead>
<tr>
<th><strong>(ENG) A1: Unmanned Systems Project</strong></th>
<th><strong>Hours:</strong> 77h 30m</th>
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<tbody>
<tr>
<td></td>
<td>Laboratory classes: 32h 30m</td>
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<td></td>
<td>Guided activities: 1h</td>
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<td>Self study: 44h</td>
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#### Description:

In this activity students will have to do a project in groups. Methodology of project-based learning, so that students have to learn autonomously topics needed to achieve the project objectives. Directed and independent learning activities consist primarily of:

- Study of self-learning materials.
- Carry out individual tasks projected
- Group meetings for project tasks.
- Completing the design and planning of the different prototypes of the project.

The activities that will be made to the class sessions:

- Resolution of doubts weekly working in small groups.
- Resolution of the most frequent questions from the professor.
- Some theoretical sessions on key issues.
- Individual and small group exercises.
- Conducting individual project tasks.
- Group meetings for project tasks.

In this activity, special attention will be devoted to the written and oral presentation of the work performed by the teams.

#### Support materials:

- Self-learning material to the contents of the subject.
- Statements of individual and group exercises.
- Detailed plan of activities and deliveries.

All material will be available through Atenea

#### Descriptions of the assignments due and their relation to the assessment:

The activity is assigned a series of individual and group deliverable. Based on these deliveries relevant feedback processes are articulated.

The completion of at least 80% of the deliverables of the course will be required to pass the course.
**Specific objectives:**
At the end of this activity, students will be able to:
- Use simulation environments for unmanned aerial systems
- Use existing flight control stations for unmanned aerial systems
- Interact with an automatic pilot of an unmanned aerial system and acquire flight telemetry data.
- To apply the existing Spanish (EASA) and European (EC/EASA) regulations on unmanned aerial systems.
- To apply the regulations on safety of operations with unmanned aerial systems in a specific operation.
- To use existing and future processes for the integration of unmanned aerial systems in low level air space (Very Low Level (VLL)).

In addition, in the context of this activity students will develop the generic skills.

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**(ENG) E1**

**Description:**
Exam 1: Answering questions on the syllabus seen so far

**Support materials:**
Bibliography and class' slides

**Descriptions of the assignments due and their relation to the assessment:**
20%

**Specific objectives:**
Validation of knowledge

**Hours:** 20h
Self study: 20h

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**(ENG) E2**

**Description:**
Exam 2: Answering questions on the syllabus seen so far

**Support materials:**
Bibliography and class' slides.

**Descriptions of the assignments due and their relation to the assessment:**
20%

**Specific objectives:**
Validation of knowledge

**Hours:** 20h
Self study: 20h

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**Qualification system**

Defined to the subject infoweb.

**Regulations for carrying out activities**

To bring personal computer to the laboratory classes.
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Bibliography

Basic:


Complementary:


Others resources:

Hyperlink

Aroca, J .M. Probabilitat i processos estocàstics. Notes de classe.