Course guides
300321 - UAS-OA - Unmanned Aircraft Systems

Unit in charge: Castelldefels School of Telecommunications and Aerospace Engineering
Teaching unit: 701 - DAC - Department of Computer Architecture.
748 - FIS - Department of Physics.

Degree: BACHELOR’S DEGREE IN AIR NAVIGATION ENGINEERING (Syllabus 2010). (Optional subject).
BACHELOR’S DEGREE IN AIRPORT ENGINEERING (Syllabus 2010). (Optional subject).
BACHELOR’S DEGREE IN AEROSPACE SYSTEMS ENGINEERING (Syllabus 2015). (Optional subject).

Academic year: 2019  ECTS Credits: 6.0  Languages: Catalan, English, Spanish

LECTURER
Coordinating lecturer: Definit a la infoweb de l'assignatura.
Others: Definit a la infoweb de l'assignatura.

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.
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. • 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>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours large group</td>
<td>32.5</td>
<td>21.48</td>
</tr>
<tr>
<td>Self study</td>
<td>84</td>
<td>56.38</td>
</tr>
<tr>
<td>Hours small group</td>
<td>33.5</td>
<td>22.15</td>
</tr>
</tbody>
</table>

Total learning time: 149 h

CONTENTS

(ENG)- Introduction to Unmanned Aircraft Systems (UAS)

Description:
1.1 Historical Evolution
1.2 Definition (UAS vs RPAS)
1.3 UAS Components
1.4 UAS Uses and Applications
1.5 Current Situation
1.6 UAS Autopilot
1.7 UAS Flight Plan and Mission Management
1.8 UAS Ground Control Stations (GCS)
1.9 Simulation Environment.

Related activities:
A1, E1 and E2

(ENG) - Spanish and European regulation of unmanned aerial systems

Description:
2.1 Spanish standards and regulations
2.2 European standards and regulations
2.3 Operational scenarios

Related activities:
E1 and E2

(ENG) - Safety in unmanned aerial systems operations

Description:
3.1 General safety aspects
3.2 Risk assessment for specific operations

Related activities:
A1, E1 and E2
**UAS Integration in non segregated airspace.**

**Description:**
4.1 Airspace management for low-level operations
4.2 Airspace management for non-segregated operations

**Related activities:**
A1, E1 and E2

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**ACTIVITIES**

**A1: Unmanned Systems Project**

**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.

**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.

**Material:**
- 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.

**Delivery:**
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.

**Full-or-part-time:** 77 h
- Laboratory classes: 32h 30m
- Guided activities: 1h
- Self study: 44h
(ENG) E1

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

Specific objectives:
Validation of knowledge

Material:
Bibliography and class' slides

Delivery:
20%

Full-or-part-time: 20 h
Self study: 20h

(ENG) E2

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

Specific objectives:
Validation of knowledge

Material:
Bibliography and class' slides.

Delivery:
20%

Full-or-part-time: 20 h
Self study: 20h

GRADING SYSTEM

Defined to the subject infoweb.

EXAMINATION RULES.

To bring personal computer to the laboratory classes.
BIBLIOGRAPHY

Basic:

Complementary:

RESOURCES

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