Course guide
300081 - SIR - System Integration in Uas

Last modified: 27/11/2020

Unit in charge: Castelldefels School of Telecommunications and Aerospace Engineering
Teaching unit: 744 - ENTEL - Department of Network Engineering.

Degree: MASTER'S DEGREE IN APPLICATIONS AND TECHNOLOGIES FOR UNMANNED AIRCRAFT SYSTEMS (DRONES) (Syllabus 2017). (Compulsory subject).

Academic year: 2020 **ECTS Credits:** 4.5 **Languages:** English

LECTURER

Coordinating lecturer: Defined in the infoweb of the course

Others: Defined in the infoweb of the course

PRIOR SKILLS

The student should have a prior understanding of basic programming concepts. No specific programming language is required, although prior knowledge of python is recommended.
Notions of computer networking are also required (basics of TCP/IP stack).

REQUIREMENTS

None

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CE3 DRONS. (ENG) CE3 DRONS Realizar la planificación y gestión de una misión, seleccionando y utilizando adecuadamente las técnicas y herramientas de soporte más adecuadas.
CE4 DRONS. (ENG) CE4 DRONS Desarrollar los sistemas más adecuados para la explotación eficiente de los datos obtenidos en la misión.

Generical:
CG1 DRONS. (ENG) CG1 DRONS Proyectar e implantar soluciones viables y rentables utilizando sistemas basados en aeronaves no tripuladas (drones) en entornos nuevos o poco conocidos dentro de contextos más amplios y multidisciplinares.

Transversal:
CT4. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.
CT5. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

Basic:
CB6 DRONS. (ENG) CB6 DRONS Poseer y comprender conocimientos que aporten una base u oportunidad de ser originales en el desarrollo y/o aplicación de ideas, a menudo en un contexto de investigación
CB9 DRONS. (ENG) CB9 DRONS Que los estudiantes sepan comunicar sus conclusiones y los conocimientos y razones últimas que las sustentan a públicos especializados y no especializados de un modo claro y sin ambigüedades.
CB10 DRONS. (ENG) CB10 DRONS Que los estudiantes posean las habilidades de aprendizaje que les permitan continuar estudiando de un modo que habrá de ser en gran medida autodirigido o autónomo.

TEACHING METHODOLOGY

The activity of the subject is organized in sessions of three hours, twice a week.
The teaching methodology combines the following components:
- Class lectures that encourage students' participation through short questions and discussions (exhibition class methodology, with support of audiovisual media, MD1)
- Practical activities for knowledge consolidation (MD3; individual work or in groups, MD5)
- Seminars, where the students, working in groups, prepare a presentation on a specific topic (MD2, MD5).
- Autonomous work in a research project on advanced topics.

LEARNING OBJECTIVES OF THE SUBJECT

At the end of the course the student should be able to:
1. Understand the importance of data management in UAS missions
2. Know the concept of middleware and its application on UAS missions
3. Know the basic operation of different architectures and communications protocols to interface a UAS.
4. Understand the characteristics of a ground-air link.
5. Ability to design and implement a testbed system integrating all the above concepts.

STUDY LOAD

Type	Hours	Percentage
Self study	85,5	76.00
Hours small group	27,0	24.00

Total learning time: 112.5 h

CONTENTS

Data Management

Description:
* Dimensions of data
* Data models
* Database Management System

Related activities:
* Exercises with python (numpy and pandas) on real mission data

Full-or-part-time: 22h
Laboratory classes: 6h
Self study : 16h

Communications middleware

Description:
* Definition of middleware
* Types of middleware
* MQTT
* DDS
* LCM

Related activities:
* Practical exercise with python's LCM library

Full-or-part-time: 22h
Laboratory classes: 6h
Self study : 16h

Interaction with autopilot

Description:
* MavLink
* STANAG
* Comparison: MavLink vs. STANAG 4586

Related activities:
* Exercise with DroneKit

Full-or-part-time: 22h
Laboratory classes: 6h
Self study : 16h

Ground Control

Description:
* Ground Control Stations
* Ground-Air communications
* Ground-Air radio-link design

Related activities:
* Student-driven seminars on related topics
* Practical exercise of system integration

Full-or-part-time: 34h
Laboratory classes: 9h
Self study : 25h

Research Project

Description:
Application and extension of the knowledge acquired on an assigned topic from a list of proposals made by teachers. Each proposal clearly defines the objective of the project and the expected results. The results of the research project will be documented in the form of a research paper.

Related activities:
* Preliminary version of the research paper.
* Evaluation of the preliminary version of at least two classmates.
* Final version of the research paper. (20%)

Full-or-part-time: 12h 30m
Self study : 12h 30m

GRADING SYSTEM

Assessment
- Final exam (40%)
- Activities: 4x deliverables (40%)
- Research project (20%)

RESOURCES

Audiovisual material:
- Lecture notes of the course. Slide deck with the contents of the course and description of the activities

Other resources:
Students will have access to a virtual Linux image with all necessary software pre-installed.