

# Course guide 220141 - UAVG - Uav Guidance & Autonomous Control

Unit in charge: Teaching unit:	Last modified: 02/04/2024       Terrassa School of Industrial, Aerospace and Audiovisual Engineering       707 - ESAII - Department of Automatic Control.
Degree:	BACHELOR'S DEGREE IN AEROSPACE TECHNOLOGY ENGINEERING (Syllabus 2010). (Optional subject). BACHELOR'S DEGREE IN AEROSPACE VEHICLE ENGINEERING (Syllabus 2010). (Optional subject).
Academic year: 2024	ECTS Credits: 3.0 Languages: English

LECTURER		
Coordinating lecturer:	Fatiha Nejjari	
Others:	Bernardo Morcego ; Vicenç Puig	

# **TEACHING METHODOLOGY**

The course is divided into the following parts: Theory classes Laboratory sessions

# LEARNING OBJECTIVES OF THE SUBJECT

This course covers the guidance and control principles that are common to many small unmanned aerial vehicles (UAVs). Building upon classical control systems and modelling theory, students will learn how to mathematically model UAV flight characteristics and sensors, develop and tune feedback control autopilot algorithms to enable stable flight control, and fuse sensor measurements using extended Kalman filter techniques to estimate the UAV position and orientation. Students will realize these concepts through both simulation and interaction with actual UAV hardware.

# **STUDY LOAD**

Туре	Hours	Percentage
Self study	45,0	60.00
Hours large group	30,0	40.00

Total learning time: 75 h



# **CONTENTS**

#### Module 1: UAV Modelling

#### **Description:**

1.1 Autonomous UAV description
1.2 UAV dynamics
1.3 UAV non linear modeling
1.4 UAV simulation

Related activities: A1, A2 and A3

**Full-or-part-time:** 14h Theory classes: 6h

Self study : 8h

## Module 2: UAV Flight Control Loop

#### **Description:**

2.1. Classical control design: PID controller...

2.2. Modern flight control design: LQR Controller, feedback linearization

**Related activities:** 

A1, A2 and A3

**Full-or-part-time:** 17h Theory classes: 7h Self study : 10h

# Module 3: UAV Navigation system

#### **Description:**

3.1. Navigation loop

3.2. Inertial navigation

3.3. Sensor fusion using Kalman filter

Related activities: A1, A2 and A3

**Full-or-part-time:** 22h Theory classes: 8h Self study : 14h



#### Module 4: Guidance and flight control

#### **Description:**

- 4.1. Overview of guidance techniques
- 4.2. Kinematic models for guidance
- 4.3. Way-point guidance
- 4.4. Path following for straight line and orbits5.

Related activities: A1, A2 and A3

**Full-or-part-time:** 22h Theory classes: 9h Self study : 13h

# ACTIVITIES

## A1. Theory lectures

**Full-or-part-time:** 14h Self study: 2h Theory classes: 12h

## A2. Laboratory project

**Full-or-part-time:** 52h Self study: 36h Theory classes: 16h

# 3. Final exam

**Full-or-part-time:** 9h Self study: 7h Theory classes: 2h

## **GRADING SYSTEM**

Final exam: 40% Project assessment: 60%