Course guide
220141 - UAVG - Uav Guidance & Autonomous Control

Last modified: 11/04/2025

Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 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: 2025 **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

Type	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
Theory classes: 12h
Self study: 2h

A2. Laboratory project

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

3. Final exam

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

GRADING SYSTEM

Final exam: 40%
Project assessment: 60%