Attitude dynamics and Guidance Navigation and Control

Academic Year: (2022 / 2023) **Review date: 16-05-2022**

Department assigned to the subject: Department of Bioengineering and Aerospace Engineering

Coordinating teacher: SANJURJO RIVO, MANUEL

Type: Compulsory ECTS Credits : 3.0

Year : 1 Semester : 1

OBJECTIVES

Basic competences

CB6 To possess and understand knowledge that provides a basis or opportunity to be original in the development and / or application of ideas, often in a research context
CB7 Students must know how to apply the knowledge acquired and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of study
CB8 Students must be able to integrate knowledge and face the complexity of making judgments based on information that, being incomplete or limited, includes reflections on social and ethical responsibilities linked to the application of their knowledge and judgments
CB9 Students must know how to communicate their conclusions and the knowledge and ultimate reasons that sustain them to specialized and non-specialized audiences in a clear and unambiguous way
CB10 Students must have the learning skills allowing them to continue studying in a way that will be largely self-directed or autonomous.

General competences

CG1 Capacity for the formulation, critical verification and defense of hypotheses, as well as the design of experimental tests for verification.
CG2 Ability to make value judgments and prioritize in making conflicting decisions using systemic thinking.
CG4 Ability to work in multidisciplinary teams in a cooperative way to complete work tasks
CG5 Ability to handle the English, technical and colloquial language.

Specific competences

CE3 Ability to develop a complete system that meets the design specifications and the expectations of the interested parties. This includes the production of products; acquire, reuse or code products; integrate products in top-level assemblies; verify products against design specifications; validate the products against the expectations of the interested parties; and the transition of products to the next level of the system.

CE10 Ability to understand and apply the knowledge, methods and tools of space engineering to the analysis and design of the guidance, navigation and control subsystem of space vehicles.

DESCRIPTION OF CONTENTS: PROGRAMME

Attitude dynamics and Guidance Navigation and Control. The program of the subject includes:

1 Introduction. Modeling and simulation
2 Requirements on AOCS
3 The kinematics, dynamics and control of 6-DOF motion
4 Navigation by star sight, inertial systems and radio systems (GPS, ranging, doppler, delta-DOR)
5 Inertial Sensors
6 State Estimation, Probability, Stochasticity and the Kalman Filter
7 Control Theory and Optimal Control
8 Case Study: Hardware on-the-loop AOCS with a hexapod

LEARNING ACTIVITIES AND METHODOLOGY

Theory sessions in master classes
Problem sessions in reduced groups
Personal and group work

ASSESSMENT SYSTEM

End-of-term exam (25%)
Continuous evaluation (75%)

In order to pass the subject, two requirements need to be met:

1) to have a MINIMUM mark of 4.0/10 in the end-of-term exam;
2) to have a minimum overall mark of 5.0/10 (weighing 25% the end-of-term exam mark and 75% the mark of the continuous evaluation).

% end-of-term-examination:	25
% of continuous assessment (assigments, laboratory, practicals…):	75

BASIC BIBLIOGRAPHY

- Wertz, James R. (Ed.) Spacecraft Attitude Determination and Control, Springer Netherlands, 1978
- Tewari, Ashish Atmospheric and Space Flight Dynamics, Birkhäuser Basel, 2007

ADDITIONAL BIBLIOGRAPHY

- F. Landis Markley; John L. Crassidis Fundamentals of Spacecraft Attitude Determination and Control, Springer, 2014