

Academic Year: ( 2020 / 2021 )

Review date: 08-07-2020

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

Coordinating teacher: CICHOCKI , FILIPPO

Type: Compulsory ECTS Credits : 6.0

Year : 1 Semester : 2

**STUDENTS ARE EXPECTED TO HAVE COMPLETED**

- BSc Aerospace Engineering courses related to: Classical mechanics, orbital dynamics, electromagnetism, thermodynamics, heat transfer, electric power, structural calculus, rocket motors, control theory, computer programming

**COMPETENCES AND SKILLS THAT WILL BE ACQUIRED AND LEARNING RESULTS.**

At the end of the course, the student shall be capable of understanding and mastering:

- The design and analysis of space systems and space missions
- The unique aspects of the space environment and the requirements it imposes on a Space System / Space Mission
- The types of Space system, Space Mission phases and procedures, and the design drivers behind each of them
- The different segments that compose a space system
- The different subsystems of the space segment in a space mission, their operation and sizing
- The space propulsion systems, launchers, and their operation
- Ground segment requirements and operation
- The certification requirements for space vehicles, and judge their acceptance levels

**DESCRIPTION OF CONTENTS: PROGRAMME**

- Introduction to Space Systems and Missions, the different segments (space, ground and launch) and subsystems.
- The space environment.
- Space Systems Engineering.
- Mission analysis: orbital maneuvers, groundtracks, mission examples in LEO, MEO, GEO and interplanetary missions
- The space segment subsystems:
  - o Space propulsion
  - o Attitude and Orbit Control (AOCS)
  - o Translational GNC
  - o Communications and data handling (onboard computer)
  - o Telemetry, tracking and telecommand
  - o Electric power
  - o Structures and mechanisms. S/C configuration
  - o Thermal control
- Launchers and access to space
- Manufacturing, assembly; certification, testing and QA
- Ground segment and operations
- End of life considerations; space debris, space law

**LEARNING ACTIVITIES AND METHODOLOGY**

The course has 29 classroom sessions (100 minutes) divided as follows:

- Theory sessions on the different course topics (21 sessions)
- Lab/Computer room sessions with practical exercises/design examples on the different subsystems (6 sessions)
- Continuous evaluation sessions, with quiz/homework (2 sessions)

The course has an estimated student workload of 150 h (6 ECTS), including personal work.

Communication with the students will be done through aulaglobal: aulaglobal.uc3m.es. Students can ask for tutorial sessions with the faculty on the hours advertised there.

#### ASSESSMENT SYSTEM

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

- 1) To have a MINIMUM grade of 4.0/10 in the end-of-term exam.
- 2) To have a MINIMUM overall grade of 5.0/10 (weighting 60% the end-of-term exam grade and 40% the continuous evaluation grade).

Continuous evaluation (40%) is based on both quizzes and homework organized during the course

For the extraordinary evaluation, the grade will be the best grade of the two:

- 1) Grade of the extraordinary exam
- 2) Grade of the extraordinary exam (60%) plus continuous evaluation grade (40%).

It is still necessary to reach a MINIMUM of 4/10 in the exam and 5/10 in the global grade to pass the course.

<b>% end-of-term-examination:</b>	60
<b>% of continuous assessment (assignments, laboratory, practicals...):</b>	40

#### BASIC BIBLIOGRAPHY

- P. Fortescue Spacecraft systems engineering, Wiley, 2011

#### ADDITIONAL BIBLIOGRAPHY

- D.A. Vallado Fundamentals of Astrodynamics and Applications, Microcosm Press, 2013
- G.P. Sutton Rocket Propulsion Elements, Wiley, 2010
- M.D Griffin Space Vehicle Design, AIAA Education Series, 2004
- P. Fortescue Spacecraft systems engineering, Wiley, 2011
- V.L. Pisacane The Space Environment and Its Effects on Space Systems, AIAA Education Series, 2008
- V.L. Pisacane Fundamentals of Space Systems, Oxford University Press, 2005
- Wertz/Everett/Puschell Space Mission Engineering, The New SMAD, Microcosm Press, 2011