Space Environment

Academic Year: (2020 / 2021) **Review date: 07-07-2020**

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

Coordinating teacher: SANCHEZ ARRIAGA, GONZALO

Type: Compulsory ECTS Credits : 3.0

Year : 1 Semester : 1

STUDENTS ARE EXPECTED TO HAVE COMPLETED

General Physics Courses

COMPETENCES AND SKILLS THAT WILL BE ACQUIRED AND LEARNING RESULTS.

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.

DESCRIPTION OF CONTENTS: PROGRAMME

1 Introduction to space environment

2 The Solar System
- 2.1 Introduction to stellar physics
- 2.2 The Sun
- 2.3 The planets of the solar System
- 2.3 The interplanetary medium and the solar wind

3 The Earth's magnetosphere
- 3.1 Regions.
- 3.2 Van Allen belts
- 3.3 Cosmic rays

3.4 Solar particle events

4 The near Earth environment I
4.1 Gravitational field
4.2 Magnetic field
4.3 Electric field

5 The near Earth environment II
5.1 The neutral atmosphere
5.2 The ionosphere

6 Plasma interactions I: spacecraft charging
6.1 Debye length
6.2. Models
6.3 Sputtering and electrical arcs
6.4 Mitigatión means

7 Plasma Interactions II: plasma waves
7.1 Linear waves in magnetized plasmas
7.2 Effects on spacecraft communications

8 Meteoroids and space debris
8.1 Models
8.2 Current state of the space debris population
8.3 International guidelines and initiatives.
8.4 Mitigation means.

9 Effects on materials
9.1 Outgassing
9.2 Radiative effects
9.3 Thermal Effects
9.3 Mitigation means

10 Effects on humans
10.1 Microgravity
10.2 Radiation
10.3 Environmental control and life support subsystem

LEARNING ACTIVITIES AND METHODOLOGY

AF1 Theoretical class
AF2 Practical classes
AF3 Practices in computer classroom
AF6 Group work
AF7 Individual student work
AF8 Evaluation activities

METHOLOGY

MD1 Exhibitions in the teacher's class with support of computer and audiovisual media, in which the main concepts of the subject are developed and the bibliography is provided to complement the students' learning.

MD3 Resolution of practical cases, problems, etc. raised by the teacher individually or in groups

MD5 Preparation of papers and reports individually or in groups

ASSESSMENT SYSTEM

EVALUATION SYSTEMS:

Final exam (60%)
Practical problems with evaluation of reports and oral exam (40%)
Required minimum mark on final exam: 4/10

% end-of-term-examination:	60
% of continuous assessment (assigments, laboratory, practicals…):	40

BASIC BIBLIOGRAPHY

- A. C. Tribble The Space Environment: Implications for Spacecraft Design, Princeton University Press, 2003

- V. L. Pisacane The Space Environment and Its Effects on Space Systems, American Institute of Aeronautics and Astronautics, 2016

ADDITIONAL BIBLIOGRAPHY

- D. A. Vallado Fundamentals of Astrodynamics and Applications, Space Technology Library, 2001

- European Cooperation for Space Standardization Space Engineering: Space Environment, ECSS-E10-04C, 2008

- O. Montenbruck and E. Gill Satellite Orbits: Models, Methods, Applications, Springer, 2001

- W. Baumjohann and R. A Treumann Basic Space Plasma Physics, Imperial College Press, 1996