Space Electronics

Academic Year: (2020 / 2021) **Review date: 08-07-2020**

Department assigned to the subject:

Coordinating teacher: ENTRENA ARRONTES, LUIS ALFONSO

Type: Compulsory ECTS Credits : 3.0

Year : 1 Semester : 2

OBJECTIVES

- Knowledge of the types of electronic functions, subsystems and components found on spacecraft
- Knowledge of the space environment and how it affects electronics
- Knowledge of the requirements of electronics used in spacecraft
- Understanding of how electronic components are developed, manufactured, qualified and selected for space applications.
- Knowledge of related standards (ECSS)

DESCRIPTION OF CONTENTS: PROGRAMME

1. Introduction
- Types of electronic functions in a S/C
  + Power electronics
  + Sensors and actuators. Drive electronics
  + Data processing units: OBCs, ICUs, etc.
  + Payload electronics
- Types of electronic circuits
  + Components off-the-shelf (COTS)
  + Application Specific Integrated Circuits (ASIC)
  + Programmable Circuits (FPGAs)

2. Electronic technology and manufacturing
- Electronic technologies. CMOS technology
- Integrated Circuit (IC) manufacturing process
- Packaging
- Assembling
- Test

3. Environmental effects on electronics
- Thermal environment
- Mechanical environment
- Radiation environment
- Radiation effects
  + Dose effects: Total Ionising Dose (TID)
  + Displacement Damage (DD)
  + Single-Event Effects (SEEs): SEL, SEU, SEFI, etc.

4. Circuit development for space applications
- Abstraction levels
- Design flow & methodology
  + Synthesis
  + Physical design
  + Simulation and Verification
  + Design tools
- Design for testability
- PCB design
- Part selection, screening, qualification and derating

5. Radiation Hardening
- Radiation hardened technologies
- Radiation Hardening by Design (RHBD). Mitigation of SEEs
- Radiation Hardness Assurance (RHA)

6. Advanced topics and emerging trends
- Jovian and Martian environments

- COTS for space
- FPGAs for space

LEARNING ACTIVITIES AND METHODOLOGY

LEARNING ACTIVITIES

- Lectures
- Theoretical and practical sessions
- Tutorials
- Team work
- Individual work

TEACHING METHODOLOGIES

- Teacher explanations supported with audiovisual media and information technology, in which the main concepts of the subject are developed and the reference literature is provided to supplement student learning.
- Demonstration of practical cases, problems, etc.. The cases are posed by the teacher and solved individually or in group.
- Presentation and discussion of related topics and practical cases
- Works and reports to be developed individually or by small teams.

ASSESSMENT SYSTEM

- Student work, that must be presented and discussed in classroom: 40%
- Final exam: 60%

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

BASIC BIBLIOGRAPHY

- John D. Cressler, H. Alan Mantooth, Eds. Extreme Environment Electronics, CRC Press, Taylor & Francis Group, 2013
- Wiley J. Larson &. James R. Wertz Space Mission Analysis and Design. Third Edition, Kluwer Academic Pub., 1999

BASIC ELECTRONIC RESOURCES

- . European Cooperation for Space Standardization (ECSS): http://ecss.nl/