

Academic Year: (2021 / 2022)

Review date: 26-05-2021

Department assigned to the subject: Department of Electronic Technology

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)

Link to document

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 (assignments, 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/>