

Academic Year: (2023 / 2024)

Review date: 27-04-2023

Department assigned to the subject: Signal and Communications Theory Department

Coordinating teacher: MORALES CESPEDES, MAXIMO

Type: Compulsory ECTS Credits : 6.0

Year : 4 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

There are no specific requirements for this subject.

OBJECTIVES

- Choose the most appropriate architectures and platforms for a problem of satellite or space communications
- Design orbits and locate the satellite in them
- Analyze the coverage through link budgets
- Choose the most appropriate modulations and multiple access techniques
- Integrally design a space or satellite communications system
- State of art of satellite communications. Satisfying the current requirements about satellite communications

DESCRIPTION OF CONTENTS: PROGRAMME

This course provides an overview of satellite communication systems and the background to address the integral design of this type of systems. The specificities of space communication systems for space missions, within the solar system and in outer space, are also tackled.

The subject covers the following topics:

1. Introduction.
 - a. History of the satellit communications
 - b. Overview of the architecture and satellite and space communications platforms
 - c. Future of satellite communications
2. Orbital concepts and angles
 - a. Satellite launching and orbital concepts
 - b. Main orbital parameters and impact on satellite communications
 - c. LEO, MEO, GEO and HEO orbits
3. Satellite subsystems, link budget and planning
 - a. Elements of satellite communcations
 - b. Transmission, amplifiers and parabolic antennas
 - c. Reception, noise and bandwidthRecepción, ruido, ancho de banda
 - d. Propagation losses, small scale effects, losses because of noise and atmospheric gases
4. Modulation and multiple access for satellite and space communications
 - a. Analog and digital modulations
 - b. Orthogonal schemes. TDMA, FDMA, CDMA
 - c. Frequency reuse
5. Satellite communications standards
 - a. Video transmission based on DVB-S
 - b. Satellite WiFi
 - c. Satellite communications for 5G/6G
6. Communications systems in space missions
 - a. Opmization of satellite communications
 - b. Two-tier (GEO-LEO) satellite systems
7. Overview of emerging systems and technologies

- a. Nanosatellites and cubesats
- b. Hiper-dense satellite constellation
- c. Very high frequency satellites

LEARNING ACTIVITIES AND METHODOLOGY

The subject is developed through lectures, problems and practical cases, illustration of the concepts through simulations and personal work of the students.

ASSESSMENT SYSTEM

Continuous evaluation

- Submission of the proposed exercises: 20%
- Final Matlab practice: 20%

Final assessment test, final exam

- Theory (50%) and problems (50%)

% end-of-term-examination:	60
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% of continuous assessment (assignments, laboratory, practicals...):	40
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BASIC BIBLIOGRAPHY

- G. Maral, M. Bousquet "Satellite communications systems: systems, techniques and technology, John Wiley & Sons, 1998
- Zhili Sun Satellite Networking: Principles and protocols, Wiley.