Course guide
230257 - TELESP - Space Telecommunications

Unit in charge: Barcelona School of Telecommunications Engineering
Teaching unit: 739 - TSC - Department of Signal Theory and Communications.
Degree: BACHELOR’S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Optional subject).
BACHELOR’S DEGREE IN ELECTRONIC ENGINEERING AND TELECOMMUNICATION (Syllabus 2018). (Optional subject).
Academic year: 2023  ECTS Credits: 6.0  Languages: English

LECTURER
Coordinating lecturer: Consultar aquí / See here: https://telecos.upc.edu/ca/estudis/curs-actual/professorat-responsables-coordinadors/responsables-assignatura
Others: Consultar aquí / See here: https://telecos.upc.edu/ca/estudis/curs-actual/professorat-responsables-coordinadors/professorat-assignat-idioma

PRIOR SKILLS
Digital communications. RF circuits and techniques. Radio links and antennas.

REQUIREMENTS
INTRODUCTION TO COMMUNICATIONS - Prerequisite
RADIATION AND PROPAGATION - Prerequisite

TEACHING METHODOLOGY
Lectures and proposed activities.

LEARNING OBJECTIVES OF THE SUBJECT
To provide students with a good knowledge of the most widespread techniques used in satellite communications. Basic contents of the course are the following. Description of a space radio link and its power balance. Multiple access and packet radio techniques. VSAT systems. Satellite-based mobile communications systems.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Hours large group</td>
<td>39,0</td>
<td>26.00</td>
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<tr>
<td>Hours small group</td>
<td>13,0</td>
<td>8.67</td>
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<tr>
<td>Self study</td>
<td>98,0</td>
<td>65.33</td>
</tr>
</tbody>
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Total learning time: 150 h
**CONTENTS**

1. Introduction

Description:
Introduction to space communications

2. A study of the environment in space.

Description:
2.1 Introduction
2.2 Orbital principles and orbits
2.3 Limitations of the space communications
2.4 Different orbits used in satellite communications
2.6 Satellite launch

3. Payload.

Description:
3.1 Introduction to the satellite subsystems
3.2 Payload description
3.2.1 Transponder
3.2.2 High Power Amplifier (non-linear HPA)
3.3 Antenna subsystem

4. Satellite channel.

Description:
4.1 Propagation in free space conditions
4.2 Atmospheric impairments
4.3 Interferences
4.4 Multipath in satellite systems (Land Mobile Satellite Channel)
4.5 Noise in satellite communications

5. Link budget

Description:
5.1 Propagation loss
5.1.1 Transmission equation. PIRE
5.1.2 Atmospheric gases attenuation
5.1.3 Rain attenuation
5.2 Noise
5.2.1 Temperature of antenna
5.2.2 Atmospheric noise
5.2.3 G/T factor
5.3 Link budget: some examples
5.4 Link budget in deep space communications
6. PHY in satellite communications.

Description:
6.1 Introduction to PHY Layer
6.2 Modulations (a satellite communications perspective)
6.3 Channel coding (a satellite communications perspective)

7. MAC in satellite communications.

Description:
7.1 Introduction to MAC techniques
7.2 FDMA / TDMA / CDMA
7.3 Random access techniques
7.4 Review of MAC techniques (a satellite communications perspective)


Description:
9.1 Recent and future ESA / NASA projects
9.2 Satellite Laser Communications
9.3 High Throughput Satellites (HTS)
9.4 Deep Space Comunications

8. Networks and digital satellite services.

Description:
8.1 Broadcast Satellite Services
DVB-S, DVB-S2, DVB-SH
8.2 Return link with satellite.
DVB-RCS. Example Amheris.
8.3 VSAT networks.
VSAT link.
8.4 Mobile Satellite Services (MSS)
Examples: Inmarsat, Iridium, Globastar.
8.5 IP satellite
Examples Inmarsat BGAN and ASTRAConnect.

GRADING SYSTEM

- Final exam : 50 %
- Midterm exam : 30 %
- Practical sessions and proposed activities: 20%
BIBLIOGRAPHY

Basic:

Complementary:

RESOURCES

Other resources:
Classroom slides. Collection of exercises and exams (with solutions).