Course guides
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 SCIENCE AND TECHNOLOGY (Syllabus 2010). (Optional subject).
BACHELOR’S DEGREE IN TELECOMMUNICATIONS SYSTEMS ENGINEERING (Syllabus 2010). (Optional subject).
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: 2021  ECTS Credits: 6.0  Languages: English

LECTURER

Coordinating lecturer: Francesc Rey.
Others: Francesc Rey.

PRIOR SKILLS

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

REQUIREMENTS

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>
</tr>
<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)

### 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 ASTRAConeet.

### GRADING SYSTEM

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

### EXAMINATION RULES
BIBLIOGRAPHY

Basic:

Complementary:

RESOURCES

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