# 230257 - TELESP - Space Telecommunications

<table>
<thead>
<tr>
<th>Coordinating unit:</th>
<th>230 - ETSETB - Barcelona School of Telecommunications Engineering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching unit:</td>
<td>739 - TSC - Department of Signal Theory and Communications</td>
</tr>
<tr>
<td>Academic year:</td>
<td>2019</td>
</tr>
<tr>
<td>Degree:</td>
<td>BACHELOR'S DEGREE IN TELECOMMUNICATIONS SYSTEMS ENGINEERING (Syllabus 2010).</td>
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<td></td>
<td>(Teaching unit Optional)</td>
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<tr>
<td></td>
<td>BACHELOR'S DEGREE IN TELECOMMUNICATIONS SCIENCE AND TECHNOLOGY (Syllabus 2010).</td>
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<td>(Teaching unit Optional)</td>
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<tr>
<td></td>
<td>BACHELOR'S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015).</td>
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<td>(Teaching unit Optional)</td>
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<tr>
<td>ECTS credits:</td>
<td>6</td>
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<tr>
<td>Teaching languages:</td>
<td>English</td>
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</tbody>
</table>

## Teaching staff

- **Coordinator:** Francesc Rey.
- **Others:** Francesc Rey.

## Opening hours

**Timetable:** This information will be provided during the first class.

## 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>Total learning time: 150h</th>
<th>Hours large group:</th>
<th>39h</th>
<th>26.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours small group:</td>
<td>13h</td>
<td>8.67%</td>
</tr>
<tr>
<td></td>
<td>Self study:</td>
<td>98h</td>
<td>65.33%</td>
</tr>
</tbody>
</table>
1. Introduction

Degree competences to which the content contributes:
Description:
Introduction to space communications

2. A study of the environment in space.

Degree competences to which the content contributes:
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.

Degree competences to which the content contributes:
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.

Degree competences to which the content contributes:
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

Degree competences to which the content contributes:
<table>
<thead>
<tr>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1 Propagation loss</td>
</tr>
<tr>
<td>5.1.1 Transmission equation. PIRE</td>
</tr>
<tr>
<td>5.1.2 Atmospheric gases attenuation</td>
</tr>
<tr>
<td>5.1.3 Rain attenuation</td>
</tr>
<tr>
<td>5.2 Noise</td>
</tr>
<tr>
<td>5.2.1 Temperature of antenna</td>
</tr>
<tr>
<td>5.2.2 Atmospheric noise</td>
</tr>
<tr>
<td>5.2.3 G/T factor</td>
</tr>
<tr>
<td>5.3 Link budget: some examples</td>
</tr>
<tr>
<td>5.4 Link budget in deep space communications</td>
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</table>

### 6. PHY in satellite communications.

#### Degree competences to which the content contributes:

**Description:**
- 6.1 Introduction to PHY Layer
- 6.2 Modulations (a satèl.lit communications perspective)
- 6.3 Channel coding (a satèl.lit communications perspective)

### 7. MAC in satellite communications.

#### Degree competences to which the content contributes:

**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.

#### Degree competences to which the content contributes:
Description:
8.1 Broadcast Satellite Services
   DVB-S, DVB-S2, DVH-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.


Degree competences to which the content contributes:

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

Qualification system

- Final examination : 50 %
- Continuous assessment : 40 %
- Proposed activities: 10%

Regulations for carrying out activities
Bibliography

Basic:


Complementary:


Others resources: