



## Course guides

# 230257 - TELESP - Space Telecommunications

Last modified: 09/06/2020

**Unit in charge:** Barcelona School of Telecommunications Engineering  
**Teaching unit:** 739 - TSC - Department of Signal Theory and Communications.

**Degree:** BACHELOR'S DEGREE IN TELECOMMUNICATIONS SYSTEMS ENGINEERING (Syllabus 2010). (Optional subject).  
BACHELOR'S DEGREE IN TELECOMMUNICATIONS SCIENCE AND TECHNOLOGY (Syllabus 2010). (Optional subject).  
BACHELOR'S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Optional subject).

**Academic year:** 2020    **ECTS Credits:** 6.0    **Languages:** English

### LECTURER

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**Coordinating lecturer:** Francesc Rey.

**Others:** Francesc Rey.

### PRIOR SKILLS

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

### REQUIREMENTS

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### TEACHING METHODOLOGY

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Lectures and proposed activities.

### LEARNING OBJECTIVES OF THE SUBJECT

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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

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Type	Hours	Percentage
Self study	98,0	65.33
Hours large group	39,0	26.00
Hours small group	13,0	8.67

**Total learning time:** 150 h



## CONTENTS

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### 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 satèl.lit communications perspective)
- 6.3 Channel coding (a satèl.lit 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, 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.

## 9. Projects and emerging technologies.

### Description:

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

## GRADING SYSTEM

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

## EXAMINATION RULES.

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## BIBLIOGRAPHY

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### Basic:

- Maral, G.; Bousquet, M. Satellite communications systems: systems, techniques and technology [on line]. 6th ed. Hoboken, N.J.: John Wiley & Sons, 2020 [Consultation: 15/04/2020]. Available on: <https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?docID=6021106>. ISBN 9781119382072.
- Gordon, G.D.; Morgan, W.L. Principles of communications satellites. New York: Wiley, 1993. ISBN 047155796X.
- Ha, T.T. Digital satellite communications. 2nd ed. New York: Macmillan, 1990. ISBN 0070253897.

### Complementary:

- Pattan, B. Satellite-based global cellular communications. New York: McGraw-Hill, 1998. ISBN 0070494177.

## RESOURCES

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### Other resources:

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