

Course guide

230257 - TELESP - Space Telecommunications

Last modified: 20/06/2024

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: 2024 **ECTS Credits:** 6.0 **Languages:** English

LECTURER

Coordinating lecturer: NEMESIO JAVIER VILLARES PIERA

Others: Segon quadrimestre:
NEMESIO JAVIER VILLARES PIERA - 11

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

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

Total learning time: 150 h

CONTENTS

1. Introduction

Description:

Introduction to space communications

Full-or-part-time: 9h 08m

Theory classes: 2h 36m

Self study : 6h 32m

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

Full-or-part-time: 41h 25m

Theory classes: 10h 24m

Laboratory classes: 4h 53m

Self study : 26h 08m

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

Full-or-part-time: 18h 16m

Theory classes: 5h 12m

Self study : 13h 04m

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

Full-or-part-time: 16h 08m

Theory classes: 3h 54m

Laboratory classes: 2h 26m

Self study : 9h 48m

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

Full-or-part-time: 16h 08m

Theory classes: 3h 54m

Laboratory classes: 2h 26m

Self study : 9h 48m

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)

Full-or-part-time: 10h 46m

Theory classes: 2h 36m

Laboratory classes: 1h 38m

Self study : 6h 32m

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)

Full-or-part-time: 10h 46m

Theory classes: 2h 36m

Laboratory classes: 1h 38m

Self study : 6h 32m

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.

Full-or-part-time: 27h 23m

Theory classes: 7h 48m

Self study : 19h 35m

GRADING SYSTEM

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

BIBLIOGRAPHY

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

Other resources:

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