

## **TEACHING GUIDE**

# **FUNDAMENTAL PRINCIPLES OF TELECOMMUNICATIONS SYSTEMS**

## **GRADO EN INGENIERIA AEROESPACIAL EN AERONAVEGACION (INGLES)**

**ACADEMIC YEAR 2013-14**

Date: 12-07-2013

<b>I.-Subject Identification</b>	
<b>Type</b>	OBLIGATORIA
<b>Teaching period</b>	3 course, 1Q semester
<b>Nº of credits</b>	6
<b>Language in wich the subject is taught</b>	English

<b>II.-Presentation</b>
<p>Dear student,</p> <p>In this course of Telecommunication System Fundamentals you will learn the principles of physical transmission of information from one end to the other. Telecommunications are much more than physical transmission, but you need to understand it first to be able to design proper modulations, electronic circuits and higher level protocols.</p> <p>Because information and disturbances suffered by the transmission can be modeled as stochastic processes, first module of this course will be dedicated to review some of the statistical knowledge you should already have. In the second module we will learn how to model communication signals. And then after that, you will learn how to calculate the impact of the physical mean (cables, fiber optic, wireless transmission) on the signal transmission. We'll finish the course by learning some basic concept of network design.</p>

<b>III.-Competences</b>
<b>Generic competences</b>
CG2. Understanding and mastering of the basic concepts relating to the general laws of mechanics, thermodynamics, electromagnetic fields and wavelengths and their application to solving engineering problems.
<b>Specific competences</b>
<p>CE19. Applied knowledge of: transmitters and receivers; transmission lines and signal sending systems for air navigation;</p> <p>CE22. Ability to communicate effectively in the relevant foreign language used professionally.</p> <p>CE24. Ability to learn and handle the concepts of signal, linear system and response in frequency for the analysis and design of communications and control systems.</p> <p>CE27. Ability to analyse and design communications systems with specific aeronautic sector requirements.</p> <p>CE28. Ability to analyse the basic principles and parameters of radio navigation systems, with special emphasis on satellite systems.</p> <p>CE29. Ability to design and evaluate air navigation and communications systems by means of computer simulation.</p>

## IV.-Contents

### IV.A.-Syllabus

#### Module 0.- Introduction

Topic 0. Introduction to the course

#### Module I.- Theory Fundamentals

Topic 1. Review of Stochastic Processes

- 1.1. Review of signals models and classification
- 1.2. Review of Statistical basics: modeling of stochastic processes

Topic 2. The Communications Channel

- 2.1. The communications channel as a Linear Time Invariant system
- 2.2. Channel degradation
- 2.3. Quality measurements for communication system

#### Module II.- Introduction to Communication Systems

Topic 3: Signal Representation in Communication Systems

- 3.1. Bandpass signals and systems
- 3.2. Representation: equivalent lowpass signal

Topic 4. Introduction to Communication Systems

- 4.1. Fundamentals
- 4.2. Analog communication systems
- 4.3. Digital communication systems

#### Module III –Transmission Lines

Topic 5: Mathematical Model and Transmission Lines

- 5.1. Propagation in transmission lines
- 5.2. Types of transmission lines

#### Module IV –Wireless Transmission

Topic 6. Radiation Fundamentals

- 6.1. Fundamentals
- 6.2. Antennas

Topic 7: Propagation

- 7.1. Propagation in free space
- 7.2. Reflection; difraction; atenuation

#### Module V - Networking Design Principles

Topic 8: Networking Design Principles

### IV.B.-Training activities

Type	Title
Practical / Problem solving	2 Mid-term (Topics 1 to 4; Topics 5 to 8)
Practical / Problem solving	2 Laboratory Practices (Topic 1 and 4)
Practical / Problem solving	5 Problem Submissions (Topic 1, 3, 4, 7 and 8)

<b>V.-Student workload</b>		
Lecture classes		30
Practical classes/problem-solving, case studies, etc.		10
Practical sessions in technological laboratories, hospitals, etc.		4
Tests		4
Academic tutorials		12
Related activities: conferences, seminars, etc.		0
Preparation of lecture classes		22
Preparation of practical classes, problem-solving, case studies, etc.		34
Test preparation		34
Total student workload		150
<b>VI.-Teaching Methodology and Organisation</b>		
Type	Period	Content
Theoretical classes	Week 1 to Week 1	Topic 0
Theoretical classes	Week 1 to Week 2	Topic 1
Other activities	Week 3 to Week 3	Problemas Topic 1
Laboratories	Week 3 to Week 3	Practice Topic 1
Theoretical classes	Week 4 to Week 4	Topic 2
Theoretical classes	Week 5 to Week 6	Topic 3
Other activities	Week 7 to Week 7	Problems Topic 3
Theoretical classes	Week 7 to Week 8	Topic 4
Other activities	Week 9 to Week 9	Problems Topic 4
Practical classes	Week 9 to Week 9	Practice Topic 4
Theoretical classes	Week 10 to Week 10	Topic 5
Theoretical classes	Week 11 to Week 11	Topic 6
Theoretical classes	Week 12 to Week 13	Topic 7
Theoretical classes	Week 14 to Week 14	Topic 8
Tests	Week 11 to Week 11	Mid-term 1

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Tests	Week 15 to Week 15	Mid-term 2
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## VII.-Assessment methods

### VII.A.-Continuous assessment

**Regular Evaluation:** If the teacher believes that attendance is mandatory shall be precisely specified.

Note: not to admit a test to a student for not complying with the minimum of support should be able to justify by the teacher using a system of proof, such as a sheet of signatures

The distribution and characteristics of assessment tests are those described below or disseminated in each academic year in the first weeks of the teaching of the subject and posted on virtual campus each group.

**Extraordinary Evaluation:** Students who fail to pass the assessment will be subject to ordinary conducting an extraordinary assessment whose value depends on the instructions given by the teacher at the beginning of the course and its virtual campus. In general it will be a test on the official dates established theoretical and / or practical.

### Comments

- **M1** = Mark in mid-term 1 (Topics 1 to 4)
- **M2** = Mark in mid-term 2 (Topics 5 to 8)
- **M3** = Average mark in problem submissions
- **M4** = Average mark in practices

**Minimum average mark in M1 and M2 = 4,5 points**

**Final mark =  $0,35 \cdot M1 + 0,35 \cdot M2 + 0,2 \cdot M3 + 0,1 \cdot M4$**

### VII.B.-Percentage for the assessment of part-time students

To be assessed using this method, the student should obtain "Academic Exemption" for the subject, applying for it to the Dean or Director of the Faculty/School in which the subject is taught."Academic Exemption" does not exclude students from continuous assessment. This kind of assessment will be decided by the teacher, assisted by the degree coordinator. The syllabus adaptation will be established in accordance with the characteristics of each specific case.

### VII.C.-Revision of the assessment tests

A fundamental element in this new teaching-learning system and continuous assessment is the permanent feedback that students receive regarding their work. This entails giving students accurate, objective and immediate information concerning the results of their performance, in order to monitor their effort and regulate their work, at the same time that this information offers a motivating element. With this goal in mind, teachers will have to establish a revision procedure of the tests and activities, indicating in each case and depending on the characteristics, the way in which this revision will be carried out, either in the classroom or during the subject tutorial.

**VII.-Bibliography**

**Referecence Generic**

Título: Communication Systems Engineering. Autor: John. G. Proakis. Editorial: Prentice Hall

Título: Sistemas de Comunicación. Autor: S. Haykin. Editorial: Wiley

Título: Digital Communications. Fundamentals and Applications. Autor: B. Sklar. Editorial: Prentice Hall

Título: Digital Communications. Autor: J. G. Proakis. Editorial: McGraw-Hill

Título: Sistemas de Telecomunicación. Transmisión por Línea. Autor: J. Hernando Rábanos. Editorial: Servicio de Publicaciones de la ETSI Telecomunicación UPM

Título: Transmisión por Radio. Autor: J. Hernando Rábanos. Editorial: Editorial Universitaria Ramón Areces

Título: Antenna Theory and Design. Autor: W.L. Stutzman, G.A. Thiele. Editorial: John Wiley & Sons

Título: Fiber-Optic Communication Systems. Autor: G. P. Agrawal. Editorial: John Wiley & Sons

**Reference literature**

Título: Communications Systems. Autores: A. Bruce Carlson y Paul B. Crilly. Editorial: Mc Graw Hill

Título: Fundamentals of Electromagnetics with Engineering Applications. Autor: S.M. Wentworth. Editorial: John Wiley & Sons

Título: Optical Communication Essentials. Autor: G. E. Keiser. Editorial: McGraw-Hill Professional

**IX.-Lecturers/Teachers/Professors**

<b>Lecturer/teacher/professor´s name</b>	Javier Ramos López
<b>E-mail address</b>	javier.ramos@urjc.es
<b>Department/field</b>	Teoría de la Señal y Comunicaciones
<b>Category</b>	Catedrático de Universidad
<b>Academic qualifications</b>	Doctor
<b>Subject Coordinator</b>	Yes
<b>Academic tutorial timetable</b>	A acordar con los alumnos
<b>Nº of Quinquenios</b>	4
<b>Nº of Sexenio</b>	3
<b>Stretch Docentia</b>	2
<b>Lecturer/teacher/professor´s name</b>	Eduardo Morgado Reyes
<b>E-mail address</b>	eduardo.morgado@urjc.es



<b>Department/field</b>	Teoría de la Señal y Comunicaciones
<b>Category</b>	Titular de Universidad Interino
<b>Academic qualifications</b>	Doctor
<b>Subject Coordinator</b>	No
<b>Academic tutorial timetable</b>	A acordar con los alumnos
<b>Nº of Quinquenios</b>	0
<b>Nº of Sexenio</b>	0
<b>Stretch Docentia</b>	1