Signature: Transmission Systems for Audio and Video
Code: 18503
Instituation: Escuela Politécnica Superior
Degree: Telecommunication Technology and Service Engineering
Level: Bacheler Degree
Type: Panoramic
ECTS: 6

TEACHING GUIDE OF THE A SIGNATURE (TRANSMISSION SYSTEMS FOR AUDIO AND VIDEO)

This teaching guide for the a signature (Transmission Systems for Audio and Video) has been approved for the academic year 2014-2015 by the Center Board and published in its final in the website of the Polytechnic School. The teaching guide approved and published before the registration period has the character of a contract with the student.

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SIGNITURE

TRANSMISSION SYSTEMS FOR AUDIO AND VIDEO

1.1. Code

18503 of Degree in Telecommunication Technology and Service Engineering

1.2. Material

Telecommunication systems

1.3. Type

Panoramic

1.4. Level

Undergraduate Study

1.5. Course

3º

1.6. Semester

2º

1.7. Number of credits

6 credits ECTS

1.8. Previous Requirements

This course is one of the itinerary of Sound & Vision. To surpass this signature, students should have a good background in the following subjects:

Previous concepts in materials and courses of Basic Training Module:

- Mathematics. It is necessary that the student has fluency in the use of basic mathematical tools: complex operations with complex numbers, vector calculus, integration and differentiation, exponential and trigonometric functions. These items have been studied in the signatures Linear Algebra (1st, 1st Semester), Mathematical Analysis I (1st, 1st Semester) and Mathematical Analysis II (1st, 2er Semester).

- Physics. The basic concepts of electromagnetism, such as definition of electric and magnetic field are discussed in the General Physics course (1st, 1st Semester). These concepts are necessary to understand the mechanism of radiated interference.

Previous concepts in Field of Telecommunications:

- Signal Processing in Communications. The filter design is one of the important elements for preventing unwanted interference effects and thus to avoid EMC problems. In this sense it is required that the student is familiar with the classical theories of views filter design subject Filter Design (2nd, 2nd Semester).

- Transmission Systems. It requires the student to know and correctly apply the concepts of electromagnetism and solving Maxwell's equations applied to different propagation environments seen in the course Fundamentals of Transmission and Wave Propagation (2nd, 2nd Semester). Concepts such as plane wave propagation, wave impedance, reflection coefficient of the wave, will be required for this course.

1.9. Minimum requirements of attending the classroom sessions

Attendance the sessions of the theory and laboratories is considered particularly useful for achieving the objectives of the course and to participate in the continuous test assessment.

Attendance at laboratory sessions is mandatory. Permission missing justified and properly documented by two practice sessions reasons. In this case the missed session must be recovered within a week in the schedule to be determined by your professor. No attending more than two practical work sessions give a rise to fail in the practical work part of the signature that has the effect of not surpassing the subject (see section 5). To facilitate a proper working environment in the lab, access

to the practical work classroom 10 minutes after the session has started will be prohibited. Similarly, except for a reasonable cause, student cannot abandon the laboratory before the end of the session.

1.10. Teaching team details

Theory Professors:

Dr. Bazil Taha Ahmed (Coordinador)
Departamento de Tecnología Electrónica y de las Comunicaciones
Escuela Politécnica Superior
Office: C-220
Telephone: +34 91 497 6207
E-mail: bazil.taha@uam.es
Web Page: http://www.ii.uam.es/~bazil
Students attention hours: By appointment requested via email

Practical work Professors:

Dr. Bazil Taha Ahmed (Coordinador)
Departamento de Tecnología Electrónica y de las Comunicaciones
Escuela Politécnica Superior
Office: C-220
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Web Page: http://www.ii.uam.es/~bazil
Students attention hours: By appointment requested via email

1.11. Objectives of the course

STAV is a signature of the itinerary of Sound & Vision. It intends that students acquire basic knowledge about the transmission systems of audio and video. The course aims to develop the ingenuity, tenacity and the ability to solve problems in the field of communication systems for audio and video services.

The competencies to be acquired with this course are:

- Ability to understand the basics of transmitting and receiving antennas.

- Ability to understand the propagation models for use later in the calculation of the working radius of each system.

- Ability to analyze and specify the basic parameters of the communications systems for audio and video

The objects of the signature are:

General objectives	
..	Understanding of the concepts of antennas
...	Study of propagation models
...	Understanding of the concept of various transmission systems

Specific objectives per topic	
TEMA 1.- ENLACES DE RADIOCOMUNICACIONES	
1.1.	Definition of antennas
1.2.	Classification of antennas
1.3.	Study of antenna´s parameters
1.4.	Design of three types of antennas
TEMA 2.- PROPAGACIÓN	
2.1.	Understanding the concept of planar and spherical waves
2.2.	Study of different propagation models
2.3.	Study the diffraction by knife edge obstacles
TEMA 3.- MODULACIONES EN SISTEMAS DE COMUNICACIONES DE AUDIO Y VÍDEO	
3.1.	Study of the analog modulations AM, FM, ASK y MSK
3.2.	Study of the digital modulations ASK , MSK, MPSK, MQAM
TEMA 4.- SISTEMAS DE RADIODIFUSIÓN DIGITAL DVB-T	
4.1.	Understanding the concepts of the system
4.2.	Planification of DVB-T system
4.3.	Study of the co-channel influence on the system coverage
TEMA 5.- SISTEMAS DE RADIODIFUSIÓN DIGITAL DAB	
5.1.	Understanding the concepts of the system
5.2.	Planification of DAB system
5.3.	Finding the coverage of the system
TEMA 6.- SISTEMAS DE RADIODIFUSIÓN DIGITAL DVB-S	
6.1.	Understanding of orbits and basic concepts
6.2.	Study of basic parameters
6.3.	Study of the uplink and downlink budget
6.4	Solving examples about the footprint of the coverage

TEMA 7.- RADIOENLACES DE SERVICIOS FIJOS	
7.1.	Understanding the structure of the system
7.2.	Study of the frequency plan
7.3.	Study of the equipment block diagrams

1.12. Program contents

Synthetic program

UNIT 1: Radiocommunication links
UNIT 2: Propagation
UNIT 3: Modulation
UNIT 4: DVB-T systems
UNIT 5: DAB systems
UNIT 6: DVB-S systems
UNIT 7: Radio links

Detailed Program

1. - ENLACES DE RADIOCOMUNICACIONES
Introduction
Types of antennas
Antenna's parameters
Receive Power
Link Budget

2. - PROPAGATION

Types of waves
Propagation Model
Diffraction by knife edge obstacles

3. - Modulations

AM, FM
ASK, MSK
BPSK y QPSK
16QAM y 64 QAM
OFDM

4. - DVB-T systems
Introduction
Transmitting antennas
Channel coding and Multiplexing
DTV-T emission

DTV-T Planification

5. - DAB systems

Characteristics
Channel coding and Multiplexing
DAB emission
DAB services
DAB Planification

6. - SISTEMAS DE RADIODIFUSIÓN DIGITAL DVB-S

Introduction
Basic parameters
Downlink budget
Examples of footprints

7. - RADIO-LINKS

Introduction
General structure
Frequency plans
Block diagram of equipments
Antennas

1.13. References

Bibliography:

1- “Transmisión por Radio”, J. M. Hernando Rábanos, José María, 6 edition, 2008. ISBN-13: 978-84-8004-856-9.

2- “Comunicaciones Móviles”, J. M. Hernando Rábanos, José María, 2 edition, 2004. ISBN: 848004635X.

3- "Antenas", Ángel Cardama, Lluis Jofre, Juan Manuel Rius, Jordi Romeu, Sebastián Blanch, Miguel Ferrando. UPC, 2002.

4- "Antenna Theory. Analysis and Design”, Constatine Balanis, John Wiley & Sons, 1997.

Electronic Material: Documents about the signature are published in the Moodle platform.

2. Study Methods

The methodology used in the development of teaching includes the following types of activities:

Theory:

- Teacher Activity

Theory classes are conducted using the slides for each topic. The Professor explains in detail every subject under study and solve a few examples about the studied topic.

- Student Activity:

Classroom Activity: Students must attend the theoretical explanation that precedes each topic.

Activity outside the classroom: Compression of the course is based on problem solving. Students should solve problems proposed in the Moodle platform. This task can be supplemented by reading the recommended literature.

Practical Work:

- Teacher Activity:

In the first 10 minutes of the practical work class, the professor explained in detail what should be done. The Professor also makes a brief questioning to each group of students at the end of each lab.

- Student Activity:

Classroom Activity: Active participation in programming with MATLAB simulations required to carry out the practices.

3. Student working hours

		Hours	Hours
Classroom	Theory Classes	42 h	70 h
	Practical work classes	28 h	
Home work	Solving proposed exercises	42 h	58 h O 80 h
	Preparing for the first call examine	16 h	
	Preparing for the second call examine	38 h	
Total number of working hours: 25 hours x 6 ECTS		**150 h**	

4. Evaluation Method

Both theory and practical work parts have a score out of 10 points. The final note of the course (NF) is obtained from the notes of theory (TE) and practical work (PR) by the following equation:

$$NF = 0.75 + 0.25 \cdot TE \cdot PR$$

To surpass the signature, it is obligatory to get a note greater than or equal to 5 points, both of theory and laboratory work. Otherwise, the final note will be:

$$NF = 0.75 \cdot \text{Min}(5, TE) + 0.25 \cdot \text{Min}(5, PR)$$

Note theory (TE)

The theory note (TE) is the result of one of the two assessment processes described below:

1 - Continuous assessment (TE- C): Attendance classroom activities and the realization of the 3 continuous assessment tests (EC1, EC2, EC3, each scored out of 10 points) planned during the course.

2 - Single evaluation (TE- U): performing a test or final exam (EF) planned in the ordinary call.

The continuous evaluation process will be assumed by default. The result of this process will be a weighted average of the tests carried out:

TE- C = (EC1 + EC2 + EC3) / 3

The single assessment process is the option for students who either did not follow the process of continuous assessment (TE- C = 0) or opting to make the final exam to pass or increase their note. In this case the note will be obtained by:

TE- U = Max (EF, 0.5 * EF + 0.5 * TE- C)

The note of the theory part only remains for the same academic year. Students who do not perform a final exam or 2 of the 3 continuous assessment tests will receive this part of the theory grade of "not assessed".

Practice Note (PR)

To surpass this part, the student must complete the practical sessions. The practice note will be obtained from the following equation results:

PR = (PR1 + PR2 + PR3 + PR4 + PR5+ PR6 + PR7+ PR8+ PR9 + PR10 + PR11 + PR12) / 12

The rating of Practice (PR) will be validated indefinitely for those students who have achieved a rating of 7.0. Otherwise, the note of practical work is only preserved for the same academic year.

5. Chronogram

weeks	Classroom hours	Practical work	Home work hours
1	3 - Introduction of the signature. **-Unit 1.- Radio links** Introduction Types of antennas	2 Practical work 0: Introduction	0
2	3 **-Unit 1.- radio links (continuation)** Antenna parameters Received power Link budget	2 Practical work 1: Design of Yagi y logarithmical antennas	5 Solving problems
3	3 **-Unit 2.- PROPAGACIÓN** Wave types Propagation Models	2 Practical work 2: Design of Yagi y logarithmical antennas	5 Solving problems
4	3 **-Unit 2.- PROPAGACIÓN (continuation)** Propagation Models (continuation) Diffraction by obstacles	2 Practical work 3: Working Radio of various systems	5 Solving problems
5	3 **-Unit3.- Modulations** AM, FM ASK; MSK BPSK, QPSK 16 QAM, 64 QAM OFDM	2 Practical work 4: Models of Hata & Hata COST- 231	5 Solving problems
6	3 **-Unit** 4: **SISTEMAS DVB-T** Introduction Working modes Codification	2 Practical work 5: Diffraction by knife edge obstacles	5 Solving problems
7	3 **-Unit 4: SISTEMAS DVB-T (continuation)**	2 Practical work 6:	5 Solving problems

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weeks	Classroom hours	Practical work	Home work hours
	Channel coding and Multiplexing DTV-T emission DTV-T Planification	: Modulations BPSK, QPSK y MQAM	
8	3 -Unit 5: SISTEMAS DAB Characteristics of the DAB system Transition modes DAB Services DAB Planification	2 Practical work 7: DVB-T Coverage without co-channel interference	5 Solving problems
9	3 **Unit 5**: **SISTEMAS DAB (continuation)** DAB Planification	2 Practical work 8: DVB-T Coverage with co-channel interference	5 Solving problems
10	3 **Unit 6. DVB-S systems** General aspects Basic parameters	2 Practical work 9: Radio systems Coverage without co-channel interference	5 Solving problems
11	3 **Unit 6. DVB-S systems (continuation)** Uplink budget Downlink Budget System examples	2 Practical work 10: Radio systems Coverage with co-channel interference	5 Solving problems
12	3 **Unit 7. Radio Links** Introduction General structure Frequency plans	2 Practical work 11: Aplicación of CST Program	5 Solving problems
13	3 **-Unit 7. Radio links (continuation)** Block diagram of equipments Antennas Interference	2 Practical work 12: Application of CST Program	5 Solving problems
14	3 Solving problems classes	2 Solving many exercises	13 Solving problems Preparation of the final examine
Control examine	0	0	7 h