VNIVERSITAT DE VALÈNCIA

Course Guide
34808 Telecommunication Electronic Systems

COURSE DATA

Data Subject	
Code	34808
Name	Telecommunication Electronic Systems
Cycle	Grade
ECTS Credits	6.0
Academic year	2017 - 2018

Study (s)

Degree	Center	Acad. year	Period
1402 - Grado de Ingeniería Electrónica de Telecomunicación	School of Engineering (ETSE)	3	Second term

Subject-matter

Degree	Subject-matter	Character
1402 - Grado de Ingeniería Electrónica de Telecomunicación	14 - Applications of electronic systems	Obligatory

Coordination

Name	Department
REIG ESCRIVA, ABILIO CANDIDO	242 - Electronical Engineering

SUMMARY

The electronic telecommunication systems course is a required subject of quarterly character that is taught in the sixth semester of the degree degree in telecommunication engineering electronics consisting of a total of 4 credits of classroom (theory and problems) and 2 credits of laboratory.

Electronic telecommunication systems course develops the necessary content to make the student aware of devices involved in a communications system. Also presents examples of equipment and subsystems of communications with their main characteristics and the comparison between them based on their fundamental parameters.

The purpose of this course is to describe the basics of telecommunications equipment so the student can be autonomous to choose the best option in terms of technology, functionality in the design and deployment of the same, and be able to anticipate problems, circumstances and situations that can affect the implementation a system. It is also proposed to provide students with basic knowledge on transmission lines and antennas, known fiber optic communication systems and have a knowledge of current telecommunications services. To strengthen this goal is that the students get to know the functioning of some of the systems and current telecommunications services.

The contents of the course are:

- **Propagation of radio waves. Electromagnetic waves. Propagation in free space. Reflection, refraction and diffraction. Ionospheric propagation and direct. Repeaters and cellular systems.**
- **Transmission lines. Electric model of a line. Propagation of waves in the lines. Losses. Coupling impedance.**
- **Antennas. Simple antennas. Characteristics of antennas. Adaptation of antennas. Arrays and reflectors. Antennas for telephony.**
- **Microwave devices. Wave guides. Microwave components. Microwave antennas. Terrestrial microwave communication systems**
- **Optical fibres. Cables. Couplers and switches. Reptidores and amplifiers.**

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

It is recommended to have studied the subjects of:

Mathematics
Physics
Circuits and electronic and photonic components

OUTCOMES

1402 - Grado de Ingeniería Electrónica de Telecomunicación

- G4 - Ability to solve problems with initiative, decision-making and creativity, and to communicate and transmit knowledge, abilities and skills, understanding the ethical and professional responsibility of the activity of a telecommunications technical engineer.
- G6 - Ability in the handling of specifications, regulations and norms of compulsory compliance.
- G7 - Ability to analyze and assess the social and environmental impact of technical solutions.
- TE1 - Ability to construct, operate and manage systems for the acquisition, transport, representation, processing, storage, management and presentation of multimedia information, from the perspective of electronic systems.
- TE2 - Ability to select specialized electronic circuits and devices for transmitting, routing and the terminals, both in fixed and mobile environments.
- TE4 - Ability to apply electronics as support technology in other fields and activities, not only in the field of Information Technology and Communications.
- TE7 - Ability to design interface, data acquisition and storage devices, and terminals for telecommunication services and systems.

LEARNING OUTCOMES

Learning Outcomes

This course allows for the following learning outcomes:

• Be able to analyze and specify the key parameters of a communications system.

• Evaluate the advantages and disadvantages of different technological alternatives for deployment or implementation of communications systems, from the standpoint of signal space, disturbance and noise.

• Autonomy in the apprehension of new knowledge and techniques for the design, development or operation of telecommunications systems and services.

• Analysis / design elements of communications from a systemic point of view.

To acquire skills

To complement the above results, this subject also to acquire the following skills and social skills:

• Ability to analyze and specify the key parameters of a communications system. It should also be able to evaluate the advantages and disadvantages of different technological alternatives for deployment or implementation of communications systems.

• Increase your self in the apprehension of new knowledge and téncicas suitable for design, development or operation of telecommunications systems and services.

• Encouraging research, developing the students' ability to analyze new problems with the tools learned.

• In the laboratory, foster teamwork. Teamwork requires cooperation, consensus, conflict resolution and respect for other team members, while requiring an ability to argue and defend one's opinions, from rational criteria and without discrimination of any kind.

• Ability to build a comprehensive and organized written document, as well as the ability to present these results in public. Our students, in their professional future, they must present analysis, studies, reports, etc.. to customers, suppliers, managers, etc.., the drafting and presentation must be clear and concise. This type of social skill is therefore of great importance.

• Ability to obtain adequate information (literature search and online) with which to tackle the analysis, design and verification of a measuring system.

DESCRIPTION OF CONTENTS

1. Transmission lines

1.1 Primary parameters of the line
1.2 The transmission line equations
1.3 Characteristic impedance
1.4 Current and voltage on the transmission line. Reflection coefficient
1.5 Input impedance of a transmission with any load impedance line
1.6 Propagation constant
1.7 Infinite line
1.8 Typically transformer
1.9 Standing wave ratio (SWR)
1.10 Wavelength and speed of propagation in the line
1.11 Phase and group velocities
1.12 Graphical analysis of transmission lines: Smith chart
1.13 Practical aspects in the transmission lines
1.14 Attenuation
1.15 Power capacity

2. Propagation

2.1 Propagation mechanisms
2.2 Propagation in free space
2.3 Density flow of power and field strength
2.4 Effective area and received isotropic power
2.5 Attenuation in free space
2.6 Forms of propagation
2.7 Propagation in conditions not of free space. Treatment from the point of view of the power
2.8 Ground wave propagation
2.9 Depth of penetration
2.10 Reflection and refraction of electromagnetic waves
2.11 Propagation in the vicinity of the Earth's surface
2.12 Spread on flat land
2.13 Transition between the ground wave and the wave of space
2.14 Considerations on the polarization in space wave propagation
2.15 Tropospheric propagation
2.16 The concept of Fresnel zone
2.17 Propagation models
2.18 Graphical methods, calculations of propagation through the FCC and CCIR curves
2.19 Attenuation models
2.20 Ionospheric propagation

3. Antennas

3.1 The role of the antenna in radio communications systems
3.2 Isotropic antenna
3.3 Power flux density
3.4 Directivity
3.5 Gain
3.6 Radiation diagram
3.7 Directivity and area of the beam
3.8 Equivalent area of an antenna
3.9 Radiation resistance
3.10 Impedance
3.11 Network bandwidth
3.12 Polarization
3.13 Electromagnetic field radiated by an element of current
3.14 Regions of radiation: near-field and far-field
3.15 The electric dipole
3.16 Folded dipole. Monopole
3.17 Loop antennas
3.18 Alignments of antennas
3.19 Principle of multiplication patterns
3.20 Antennas with reflector

4. Microwaves

4.1 Wave guide
4.2 Special wave guides
4.3 Resonant cavities
4.4 Bipuerta waveguide
4.5 Dispersion and transmission coefficients
4.6 Measurement of parameters of network
4.7 Characteristic frequencies
4.8 Analysis of junctions

5. Optic fiber

5.1 Optical fibers
5.2 Losses in fibers
5.3 Dispersion and non-liearidades
5.4 Noise of the receiver and Bit Error Rate
5.5 Losses: Optical amplifiers
5.6 Dispersion management Tnecnicas
5.7 Management of non-linear effects
5.8 WDM systems

WORKLOAD

ACTIVITAT	Hours	% To be attended
Theory classes	30.00	100
Laboratory practices	20.00	100
Classroom practices	10.00	100
Attendance at events and external activities	10.00	0
Development of group work	10.00	0
Development of individual work	5.00	0
Study and independent work	5.00	0
Readings supplementary material	5.00	0
Preparation of evaluation activities	10.00	0
Preparing lectures	30.00	0
Preparation of practical classes and problem	15.00	0
TOTAL	**150.00**	

TEACHING METHODOLOGY

The development of the course is structured around four themes: the theory and problem solving sessions, tutorials, presentation of evidence of continuous assessment and presentation of technical documentation testing practices.

Group learning with the teacher

The sessions of theory and problems using the model of lecture. In the theoretical sessions the teacher will present the fundamental contents of this subject using the media at their disposal, (presentations, transparencies, blackboard). In the problem sessions, the professor will explain a number of problems-type, through which the student will learn to identify the essential elements of posing and solving problems. They also use the participatory approach to the problem sessions, which is to prioritize the communication between students and student / teacher. To this end, the teacher will advance which day will be devoted to solving problems and what problems could be solved, so that the student can attend these classes with the approach of the problems, but its resolution will be completed in class forming groups of four or five students who then have to go to the blackboard to explain the problem and resolve the doubts that have the other fellow.

Tutorials

The students will have a schedule of tutoring whose purpose is to solve problems, questions, guidance on jobs, etc.. The schedule of these tutorials will be indicated at the beginning of the academic year. They will also have the opportunity to clarify some questions via email or discussion forums by using the tool "Virtual Classroom" which provides the University of Valencia.

individual study

A voluntary student may submit the resolution of a series of quizzes in total have 7 continuous assessment tests (PEC, one per lesson). These tests are voluntary self-assessment and should be resolved exclusively by students without any help from the teacher.

Group work with colleagues

The practice groups will consist of a maximum of two people, which should be organized for the design, installation and experimental evidence. Each practice will consist of two distinct parts each with an estimated duration of 2 hours. The first part is theoretical and its resolution is required to perform the second part of a purely experimental.

Teaching materials available

To make a success of the teaching methodology described the student has the Virtual Classroom, from the beginning of the academic year, the following documents:

• **Teaching Guide** provides the information elements sufficient to determine what it is intended that the student learns, how it will do, under what conditions and how it will be evaluated.

• **Guidelines for the Study** of the different lessons, structured in the following sections:

- Presentation.
- Objectives and skills acquired.
- Content and timing.
- Comments to the material.
- Fundamentals.
- Further Reading.
- Comments or additional.

• **Transparencies** of each course topic.

• **Newsletter problems** in each lesson.

• **Continuous Assessment Tests (PECs**) from each of the thematic units.

• **The practice outlines** the following structure:

- Objectives.
- Material.
- Prior knowledge.
- Theoretical basis.

Activities and experimental procedure.

EVALUATION

For the evaluation of the subject there exist two alternatives:

A) Final examination of the theoretical and practical content taught in the classroom and the exercises that proposes to make the professor in the laboratory. To overcome the subject the student should obtain in the theoretical-practical test a minimum rating of 5 points on a total of 10 points and, additionally, overcome the laboratory test proposed by the professor. The final grade will be given by the result of the theoretical-practical test, while overcoming the lab test will be a necessary condition to pass the subject but will have no impact on the final note.

B) Continuous evaluation of the work done during the course. Students who opt for this assessment procedure must attend mandatory both the theoretical and practical sessions and laboratory sessions in the subject. The evaluation will be as follows:

1. Exams for each of the thematic blocks in which the lecturer divides the subjet, up to 6 points. According to the following conditions:

1.1. Such exams will take place in class and consist of multiple choice questions or questions of theory and practice of numerical application. To overcome the subject its needed to obtain as average of all the exams a minimun mark of 5 points over 10.

1.2. In addition. it will be necessary to obtain a minimun mark in each exam of 4 points over 10.

2. Student work, up to 2 points, broken down as follows:

2.1. Participation in class, the teacher answers questions and solving exercises in class: up to 1 points.

2.2. Solving exercises and other deliverables in tutorials Non-volunteer to be agreed with the teacher: Up to 1 points

3. Continuous assessment of laboratory, up to 2 points. Obtained by:

3.1. The students will answer a test after each laboratory project, to determine the mark for each laboratory project.

3.2. The final mark will be the average of all the laboratory project marks. The unattendance to any of the laboratory sessions will provide a 0 mark for the corresponding laboratory project.

Students who have opted for the B form of assessment during the teaching of the subject and have not passed will be evaluated by the type A.

In any case, the evaluation system will be governed by the one established in the Regulation of Evaluation and Qualification of the University of Valencia for Degrees and Masters (Https://webges.uv.es/uvTaeWeb/MuestraInformacionEdictoPublicoFrontAction.do?accion=inicio&idEdictoSeleccionado=5639)

REFERENCES

Basic

- Antenna Theory: Analysis and Design. Balanis, C.A. 2nd Ed. Joh Wiley & Sons, Inc. 1997
- Microwave Engineering, David M. Pozar, 4th Edition, Wiley, 2011

Additional

- Sistemas de Comunicaciones Electrónicas. W. Tomasi. 4ª edición. Prentice-Hall. 2003
- Antenas, Ángel Cardama, 2ª Edición, Edicions UPC, 2002
- Foundations for Microwave Engineering, Robert E. Collin, 2nd. Ed. IEEE Press 2001