SUBJECT TEACHING GUIDE

G821 - Electromagnetic and Acoustic Waves

Degree in Telecommunication Technologies Engineering
First Degree in Telecommunication Technologies Engineering

Academic year 2024-2025

1. IDENTIFYING DATA					
Degree	Degree in Telecommunication Technologies Engineering First Degree in Telecommunication Technologies Engineering			Type and Year	Compulsory. Year 2 Compulsory. Year 2
Faculty	School of Industrial Engineering and Telecommunications				
Discipline	Subject Area: Electromagnetic and Acoustic Waves Module in Common with the Telecommunications Branch				
Course unit title and code	G821 - Electromagnetic and Acoustic Waves				
Number of ECTS credits allocated	6	Term		Semester based (2)	
Web					
Language of instruction	Spanish	English Friendly	Yes	Mode of delivery	Face-to-face

Department	DPTO. INGENIERIA DE COMUNICACIONES
Name of lecturer	TOMAS FERNANDEZ IBAÑEZ
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Office	Edificio Ing. de Telecomunicación Prof. José Luis García García. Planta: - 1. DESPACHO (S142)
Other lecturers	JUAN LUIS CANO DE DIEGO

3.1 LEARNING OUTCOMES

- Learn the basics of the generation and propagation of electromagnetic signals in transmission lines and waveguides . Analyze devices liabilities based on more conventional transmission lines . Knowing the way the acoustic wave propagation and the basics of their generated . Ability to analyze and design systems using acoustic components, devices and electro acoustic systems. Analyze the radiated electromagnetic waves. Generation through antennas, knowing the fundamentals antennas most basic , para different frequency bands.

4. OBJECTIVES

Understanding capacity and master the general laws of electromagnetic and acoustic waves.
Ability to acquire the basics of signal propagation in space, comprising the mechanisms wave propagation and transmission in the art .
Ability to analyze the propagation of sound waves in different physical media
Capacity development of problem solving in the areas of knowledge previous.
Performing simulation of a practical wave transmission system.
Oral defense of the work on propagation of electromagnetic and sound waves..
Specific Skills
Development of a written work and oral presentation of it using new information technologies.
Literature search.
Team work.
Internet search .
Developing a theme using new resources.
LEARNING OUTCOMES OF THE COURSE
To give students a basic training in general aspects of the propagation of electromagnetic and acoustic waves .
OBJECTIVES OF SUBJECT
The overall objective of the course is to get students to understand the electromagnetic propagation and the generation and propagation of acoustic waves. Human acoustic system. Time and frequency characterization of acoustic signals . Electroacoustic.

6. SUBJECT PROGRAM	
CONTENTS	
1	Topic 0: Review of Vector Analysis: Basic laws of vector algebra. Position and distance vectors. Vector multiplication. Scalar and vector triple products. Orthogonal coordinate systems. Cartesian coordinates Cylindrical coordinates Spherical coordinates transformations between coordinate systems Gradient of a scalar field Properties of the gradient operator Divergence of a vector field. Topic 1: Maxwell's equations. Gauss's law for electric fields. Permittivity of free space. Differential form of Gauss's law. Nabla, the delta operator. Gauss's law for magnetic fields. Differential form of Gauss's law for magnetic fields. The divergence of the magnetic field Faraday's law, integral form The induced electric field Differential form of Faraday's law. The rotational. The rotational electric field. Ampere-Maxwell law Vacuum permeability. Differential form of Ampere-Maxwell's law. Electric current density Displacement current density Topic 2: Maxwell's equations in material media. Divergence theorem Stokes' theorem The gradient. Basic operators of vector algebra. Gauss's law for electric fields. Displacement vector Differential form of Gauss's law. Integral form of Gauss's law. Ampere-Maxwell's law differential form of Ampere-Maxwell's law Integral form of Ampere-Maxwell's law.
2	Topic 3: The Plane Wave Wave propagation in free space. General plane wave equation for the electric/magnetic field. TEM wave. Velocity of propagation. General solution for the electric field Phasors Phasor notation for electric field and magnetic field. Solution to the wave equation using phasors. Helmholtz vector equation in free space. Solution for electric field and magnetic field Concept of intrinsic impedance of the medium. Propagation in dielectrics Concept of losses in dielectrics. Tangent of losses Complex impedance. Propagation in conductors Conductivity. Poynting vector. Poynting's theorem Propagation in good conductors Skin effect. Wave equations of electric and magnetic fields in good conductors. Wave polarisation Linear polarisation. Circular polarisation. Elliptical polarisation. Topic 4: REFLECTION AND TRANSMISSION OF FLAT WAVES. Normal incidence. Reflection and transmission of waves with oblique incidence. Snell's laws. Perpendicular polarisation. Parallel polarisation. Coefficient of reflection and transmission Brewster's angle

3	Topic 5: Guided Propagation. Introduction. Propagation modes. General equations for guided waves. Transmission lines. Ideal line without losses. Lossy line. Low loss line Circuit parameters of the most common lines, coaxial and two-wire lines. Strip lines. Microstrip lines terminated line Reflection coefficient Input impedance and admittance Standing waves Standing wave ratio Terminated line: power Line with generator and load Topic 6: Waveguides General solutions of the modes. Rectangular waveguide.
4	Topic 7: Acoustic Waves Types of Mechanical Waves: Periodic Waves: Transverse Periodic Waves and Longitudinal Periodic Waves. Mathematical Representation of the Wave: Wave Function of a Sinusoidal Wave Phase Velocity Velocity and Acceleration of a Particle in a Sine Wave: Wave Equation Energy in Wave Motion and Wave Intensity Wave Interference, Boundary Conditions and Superposition Standing waves on a rope. Normal modes in a string Interference in Acoustic Waves Physiological Qualities of Sound: Loudness, Pitch, Timbre, ADSR Curve

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
Description Written test of exercises corresponding to Block 1 (Topics 1-2)	Written exam	No	Yes	20,00
Description Written test of exercises corresponding to Block 2 (Topics 3-4) Minimum mark required: 3.0 / 10.0	Written exam	No	Yes	30,00
Description Written test of exercises corresponding to Block 3 (Topics 5-6) Minimum mark required: 3.0 / 10.0	Written exam	No	Yes	30,00
Description Written test of exercises corresponding to Block 4 (Topic 7)	Written exam	No	Yes	10,00
Description Evaluation of laboratory practice and work	Others	No	No	10,00
Description Final exam	Written exam	Yes	Yes	0,00
TOTAL				100,00

Observations

Continuous Assessment: Continuous assessment presupposes regular class attendance and the completion of all assessment tests (written exams at the end of each block).

The final grade will be obtained from the weighted average of the results obtained in the four written exams together with the evaluation grade of the laboratory practicals.

Students who have not passed the continuous assessment will have the right to take a final exam, on the date established by the centre, to make up for the parts not passed.

The laboratory practicals cannot be made up.

Observations for part-time students

Teaching and evaluation methods, compatible with the personal circumstances that the student accredits, will be proposed.

8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC

Fundamentos de aplicaciones en electromagnetismo / Fawwaz T. Ulaby.
5ª ed.Naucalpan de Juárez : Pearson Educación de México, 2007.
ISBN:978-970-26-1055-7

Fundamentals of applied electromagnetics / Fawwaz T. Ulaby, Eric Michielssen, Umberto Ravaioli.
Edición: 6th ed. Editorial: Upper Saddle River, New Jersey : Prentice Hall, cop. 2010.
Sears, Zemansky, Young & Freedman, “Física Universitaria”, Ed. Décimo primera.Pearson Education. 2009
Fundamentos De Acustica por Kinsler, Editorial Limusa S.a De C.v. - Mexico Año de Edición: 1995