



ESCUELA SUPERIOR POLITÉCNICA DEL LITORAL
Faculty of Electrical and Computer Engineering
COURSE SYLLABUS
Propagation

1. CODE AND NUMBER OF CREDITS

CODE	FIEC00729	
NUMBER OF CREDITS : 4	Theoretical: 4	Practical: 0

2. COURSE DESCRIPTION

Propagation curriculum focuses on studying the properties of wireless transmission media, as well as Propagation of radio signals basis so that through them , to set design, optimize and provide.

Accurate maintenance of Radio communication Systems. At the end of the course, students will be prepared to understand the mechanisms of propagation and Transmission of electromagnetic waves; apprehend the different components of a communication system, as well as correlate each frequency carrier with the dominant propagation mechanism.

3. PRE-REQUISITES AND CO-REQUISITES

PRE-REQUISITES	FIEC03442 ELECTROMAGNETIC THEORY II FIEC04952 ANALOG COMMUNICATIONS
CO-REQUISITES	

4. CORE TEXT AND OTHER REQUIRED REFERENCES FOR THE TEACHING OF THE COURSE

CORE TEXT	1. Propagation for Wireless Communication Systems, Simon R. Saunders, Wiley & Sons, 2 nd Edition, 2007
REFERENCES	1. John S. Seybold, Introduction to RF Propagation, 1 st edition, 2005, Wiley-Interscience

5. COURSE LEARNING OUTCOMES

At the end of the course, the student will be able to:

1. After completing the course the student will have assimilated the theoretical basis and developed skills that enable him to outline and design a wireless network. With this purpose the course emphasizes the study of channel modeling. Allowing him to understand and apply the software packages in telecommunications network planning.

6. COURSE PROGRAM

- I. INTRODUCTION TO RADIO WAVE PROPAGATION (2 sessions - 4 hours).
 - Classification of Radio Waves according to Propagation Mode
 - Properties of Electromagnetic Waves
 - Maxwell equation and Radiation
 - Fundamentals of Antennas: Radiation Pattern, Dipoles and Array
 - Radar Equation
 - Noise Temperature
- II. LARGE SCALE PROPAGATION (5 sessions - 10 hours).
 - Propagation on Flat Earth and Spherical Earth
 - Mechanisms of Propagation: Reflection, Refraction and Diffraction
- III. LINK DESIGN RADIO (1 session - two hours)
 - Line of Sight
 - Path Loss
 - Power Link Budget
- IV. SURFACE WAVES PROPAGATION (1 session - two hours)
 - Van der Pol formula for Antenna at ground level



- V. Microwave Propagation (3 sessions - 6 hours)
 - Propagation by Diffraction of terrestrial curvature
 - Knife effect, multiples knives and wedge in building
 - Fresnel Radio and Rayleigh principle about rough surfaces
- VI. PROPAGATION troposphere (5 sessions - 10 hours)
 - Troposphere and Tropospheric Refraction. Giovanelli method
 - Attenuation in Rain, and Absorption by Gases
 - Ionospheric Effects: Faraday rotation, Group Delay and Dispersion
- VII. EMPIRICAL PATH LOSS MODELS (6 sessions - 12 hours)
 - Loss Empirical Model of Stroke
 - Macrocells
 - Model OKUMURA-HATA
 - Model COST 231
 - Shadowing Effect
 - Statistical Characterization
 - Local Variability and Correlation by Shadows
 - Gaussian probability density, Log Normal, Rayleigh and Ricean
 - Fading and multipaths
 - Log Normal Fading
- VIII. SPREAD SMALL SCALE (3 sessions - 6 hours)
 - Small-Scale Fading
 - Delay Spread
 - Doppler Spread
 - Fast Fading in Narrowband Channel
 - Fast Fading in Broadband Channel
 - Indoor Propagation Empirical Model
 - Model ITU
 - Model COST 231 and Ericson Model
 - Criteria of Diversity In Space, Time and Frequency
- IX. BIOLOGICAL EFFECTS OF ELECTROMAGNETIC RADIATION (1 session - two hours)
 - Biological Effects of Exposure to Radio Frequency
 - FCC Regulations
- X. MEASUREMENT METHODS AND SURVEY OF RADIO (1 session - two hours)
 - Planning and Survey of the surroundings
 - Site Evaluation. and Risk measurements
 - Electromagnetic measurement

7. WORKLOAD: THEORY/PRACTICE

2 sessions per week. Each sessions 2 hour

8. CONTRIBUTION OF THE COURSE TO THE EDUCATION OF THE STUDENT

The course contributes to the theoretical basis of an Engineer in Electronics and Telecommunications

BASIC TRAINING	PROFESSIONAL TRAINING	SOCIAL SKILLS DEVELOPMENT
	X	

9. THE RELATIONSHIP BETWEEN THE LEARNING OUTCOMES OF THE COURSE AND THE LEARNING OUTCOMES OF THE DEGREE PROGRAM

LEARNING OUTCOMES OF THE DEGREE PROGRAM*	CONTRIBUTIO N (High, Medium, Low)	LEARNING OUTCOMES OF THE COURSE**	THE STUDENT MUST:
a) An ability to apply knowledge of mathematics, science and engineering.	High	1	Apply the knowledge acquired in Electromagnetic Theory, Probability and Analog Communications



b) An ability to design and conduct experiments, and to analyze and interpret data	--	--	--
c) An ability to design a system, component or process to satisfy realistic constraints.	--	--	--
d) An ability to function on multidisciplinary teams.	--	--	--
e) An ability to identify, formulate and solve engineering problems.	Medium	1	Identify and resolve problems concerning the obstruction to line sight
f) An understanding of ethical and professional responsibility.	Low	1	Draw up presentations of current technological topics in timeliness dates
g) An ability to communicate effectively.	--	--	--
h) A broad education necessary to understand the impact of engineering solutions in a social, environmental, economic and global context.	--	--	--
i) A recognition of the need for, and an ability to engage in life-long learning.	Low	1	Research in presentations
j) A knowledge of contemporary issues.	Low	1	Continually review technological advances in all areas in order to adapt them to our environments
k) An ability to use the techniques, skills, and modern tools necessary for engineering practice.	Low	1	MATLAB source codes are provided for resolving typical problems and to find communications system parameters
l) Capacity to lead, manage and undertake projects.			

10. EVALUATION IN THE COURSE

Evaluation activities	
Exams	X
Tests	X
Homework/tasks	X
Projects	
Laboratory/Experiments	
Class participation	X
Visits	
Other	X

11. PERSON RESPONSIBLE FOR THE CREATION OF THE SYLLABUS AND THE DATE OF ITS CREATION

Created by	Eng. Pedro Vargas Gordillo
Date	Mayo 13 th, 2013



12. APPROVAL

ACADEMIC SECRETARY OF THE ACADEMIC DEPARTMENT	DIRECTOR OF TECHNICAL ACADEMIC SECRETARY
NAME: Mrs. Leonor Caicedo G.	NAME: Eng. Marcos Mendoza
SIGNATURE: 	SIGNATURE: ESCUELA SUPERIOR POLITÉCNICA DEL LITORAL
Date of approval by the Directive Council: 2013-537 2013-10-7	----- Ing. Marcos Mendoza V. DIRECTOR DE LA SECRETARIA TÉCNICA ACADÉMICA

13. VALIDITY OF THE SYLLABUS

RESOLUTION OF THE POLYTECHNIC BOARD:	13-12-343
DATE:	2013-12-12