ESCUELA SUPERIOR POLITÉCNICA DEL LITORAL
Faculty of Electrical and Computer Engineering
COURSE SYLLABUS
Probability and Stochastic Processes

1. CODE AND NUMBER OF CREDITS

CODE	FIEC03236	
NUMBER OF CREDITS : 4	**Theoretical: 4**	**Practical: 0**

2. COURSE DESCRIPTION

The course Probability and Stochastic Processes presents the concepts and basic probabilistic models used to solve problems in systems telecommunications. The course material includes the study from the concept of a random variable to the power spectral density of stationary stochastic processes especially those in the broad sense.
The course emphasizes the student's exposure to a range of exercises that will help to the understanding of random phenomena and the individual and group solution of specific problems.
At the end of the course students will be prepared to analyze and use probabilistic formulas to apply it in advanced courses or in professional practice.

3. PRE-REQUISITES AND CO-REQUISITES

PRE-REQUISITES	ICM00166 STATISTICS FIEC05058 LINEAR SYSTEMS FIEC04382 SIGNALS AND SYSTEMS
CO-REQUISITES	

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

CORE TEXT	1. "Probability and random process for electrical engineering". Author: Alberto León-García. Editorial: Addison-Wesley Publishing Company, Second edition, 1994
REFERENCES	1. "Probability and random variables, and stochastics processes". Author: Athanastos Papoulli. Editorial: McGraw Hill, Third edition, 1991. 2. "Stochastics Processes". Author: Sheldon M. Ross. Editorial: Academic Press. Inc, 1983.

5. COURSE LEARNING OUTCOMES

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

1. Analyze and apply basic concepts of probability theory with principal focus on the study of single and multiple random variables, functions and sum of random variables, Central Limit theorem, Stochastic Processes and Power Spectral Density.

6. COURSE PROGRAM

I. RANDOM VARIABLES (sessions - 11 hours).
- Definition.
- The cumulative distribution function (cdf).
- The probability density function (pdf). Important discrete and continuous random variables and their density function.
- Functions of one random variable. Expected value of x and f (x). Variance.
- Chevyshev inequality.
- Transformation methods. Characteristic function and moment theorem. Generating function

II. MULTIPLE RANDOM VARIABLES. (Sessions - 11 hours).
- Vector variables. Events and probabilities.
- Two random variables. Joint pdf and cdf. Marginal functions.
- Independence of two random variables.
- Conditional probability and conditional expected value.
- Multiple random variables. Joint distribution and independence. Chain Rule.
- Functions of several random variables. One function of several random variables. Pdf of linear and general

transformation.
- Expected value of functions of random variables. Correlation and covariance of two random variables. Joint characteristic function.
- Jointly Gaussian random variables. Linear transformation.

III. SUM OF RANDOM VARIABLES (sessions - 11 hours).
- Sums of random variables. Mean and variance of sums. Pdf of sum of independent random variables.
- Central limit theorem.

IV. STOCHASTIC PROCESSES. (Sessions - 11 hours).
- Definition. Specifying a stochastic process. The mean, autocorrelation and autocovariance functions. Multiple random processes. Cross-Correlation and cross covariance.
- Examples of discrete-time and continuous time stochastic processes. Iid and sum processes. Poisson process and random telegraph signal.
- Stationary random processes. Wide sense stationary random processes (WSS). Autocorrelation function of a WSS process. Properties.
- Ciclostationary random processes.
- Time average in random processes and the ergodic theorems.

V. ANALYSIS AND RANDOM SIGNAL PROCESSING. (Sessions - 12 hours).
- Power spectral density (PDF). Wiener-Khintchin theorem. Power spectral density of continuous time and discrete time random processes.
- Power spectral density as a time average. Formula.
- The response of a linear systems to random signals.
- White noise random process.
- Amplitude modulation by random signals.

7. WORKLOAD: THEORY/PRACTICE

2 sessions per week for 2 hours

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

The course Probability and Stochastic Processes are oriented theoretical capacity of an engineer to facilitate their understanding of problems in the field of telecommunications which require probabilistic modeled.

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*	CONTRIBUTION (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 knowledge of stochastic processes in the following communication courses.
b) An ability to design and conduct experiments, and to analyze and interpret data	---	0	
c) An ability to design a system, component or process to satisfy realistic constraints.	---	0	
d) An ability to function on multidisciplinary teams.	---	0	
e) An ability to identify, formulate and solve	Medium	1	Learning to translate specifications operation circuits finished.

	engineering problems.			
f)	An understanding of ethical and professional responsibility.	---	0	
g)	An ability to communicate effectively.	Low	0	Take assessments, submit assignments and class discussion topics the course.
h)	A broad education necessary to understand the impact of engineering solutions in a social, environmental, economic and global context.	---	0	
i)	A recognition of the need for, and an ability to engage in life-long learning.	Low	0	Be prepared to discuss and research new issues on probabilistic models.
j)	A knowledge of contemporary issues.	---	0	
k)	An ability to use the techniques, skills, and modern tools necessary for engineering practice.	High	1	Simulation in Matlab
l)	Capacity to lead, manage and undertake projects.	---	0	

10. EVALUATION IN THE COURSE

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

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

Created by	Ing. María Antonieta Alvarez
Date	03 MAY 2013

12. APPROVAL

ACADEMIC SECRETARY OF THE ACADEMIC DEPARTMENT	DIRECTOR OF TECHNICAL ACADEMIC SECRETARY
NAME: Mrs. Leonor Cedeño G.	NAME: Eng. Marcos Mendoza
SIGNATURE:	SIGNATURE: ESCUELA SUPERIOR POLITÉCNICA DEL LITORAL
Date of approval by the Directive Council: 2013-557 2013-10-7	Ing. Marcos Mendoza V. DIRECTOR DE LA SECRETARÍA TÉCNICA ACADÉMICA

13. VALIDITY OF THE SYLLABUS

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