University of New Mexico, Albuquerque
Department of Electrical and Computer Engineering
EECE-340: Probability and Statistics
Fall Semester 2002, 3 Credit Hours

COURSE INFORMATION:

Course Instructor	Prof. Balu Santhanam
Office Location	Room 326A, EECE Bldg.
Contact Info	Email: bsanthan@eece.unm.edu
	Tel: (505) 277-1611 , Fax: (505) 277-1439
Prerequisite	EECE-314, Math-314, Basic knowledge of MATLAB
Location	DSH–132
Lectures	MWF: 1:00-1:50 PM
Textbook	Alberto Leon Garcia, ”Probability and Random Processes
	for Electrical Engineering”, Second Edition,
	Addison Wesley, New York, 1994.
Office Hours	TBA

GRADING SCHEME:

Problem Sets/Computer Projects : 10%
Midterm I : 25%
Midterm II : 25%
Final Exam : Dec 13th, Wed: 40%

REFERENCES:

- Sheldon Ross, "A First Course in Probability," sixth edition, Prentice Hall Inc, Upper Saddle River, New Jersey, 1998.

- Athanasios Papoulis, "Probability and Statistics," Prentice Hall Inc, Upper Saddle River, New Jersey, 1990.

- P.Z.Peebles Jr, "Probability, Random Variables, and Random Signal Principles," fourth edition, McGraw-Hill Inc, New York, 2001.

- R.A. Johnson, "Miller and Freund's: Probability and Statistics For Engineers," sixth edition, Prentice Hall Inc, Upper Saddle River, New Jersey, 2000.

Course Objecties

The intent of the course is to introduce basic concepts of probability theory, random variables, random signal model. The emphasis will be on applications of probability theory arising in communications, signal detection, product reliability testing etc.

UNM Catalog Outline

Probability axioms, random variables, mean, variance, Chebyshev inequality, characterisitic functions, transformations of random variables, confidence intervals, jointly defined random variables, multivariate Gaussian variables, conditional probability densities, random processes, correlation, power spectrum, white noise, Markov processes and chains, transmission of noise through LTI systems.

Syllabus

1. **Basic Concepts of Proability Theory**: random experiments, set operations, axioms of probability, discrete and continuous sample spaces, counting methods, conditional probability, mutually exclusive events, independence of events, sequential experiments.

2. **Random Variables (RV)**: Notion of a RV, CDF of a RV, PDF of a RV. Binomial, Poisson, Uniform and Gaussian RV's, functions of a RV, mean, variance and moments of a RV, Markov and Chebyshev Inequalities, characteristic functions and probability generating functions, application to reliability calculations. MATLAB-based random number generators.

3. **Multiple RV's**: random vector, pairs of random variables, joint PDF and CDF, independence of random variables, conditional probability and expectation, functions of random vectors, multivariate Gaussian distribution, covariance matrices.

4. **Law of large numbers**: sample mean, sums of independent RV's, law of large numbers, central limit theorem, confidence intervals.

5. **Random processes**: definition, classification, specification, examples, stationary random processes, autocorrelation, autocovariance, power spectrum, average power, white noise model, response of a LTI system to random signals, Markov processes and Markov chains.

6. **Applications to communications**: packet-based voice transmission example, binary detection in AWGN, entropy of a random variable, amplitude modulation by random signals, frequency-coding based communications, equalization, TDMA, FDMA.

Additional Information

Course Webpage

The webpage for the course is located at `www.eece.unm.edu/ faculty/bsanthan` under EECE-340. Information regarding homework, homework solutions, MATLAB assignments, MATLAB resources, problem sessions etc, will be posted here so please check there often. ITV students particularly should make use of the webpage and email resources to reach me because I am in an out on certain days, but I can be reached via email.

Library and Computer Resources

There will be a folder for EECE-340 at the *centennial science and engineering library* (CSEL) reserve desk. I will also be putting some of the reference material on reserve so that they can be checked out for a limited period of 2 hours. In regards to the computing resources, you should obtain a EECE computer account if you do not already have one. There is an online application form that you need to fill in and submit once you are in the EECE network this will give you access to the EECE Unix and Windows machines that have MATLAB 6.1 loaded on them. These will come in handy during the MATLAB assignments. For those of you taking the course through ITV, I will have most of the handouts and problem sets on the course webpage, so incase you get the tapes late or if you are unable to make it to a class please avail yourself of the notes and material on the course webpage.

Policies and Assumptions

Homework and Office Hours

Homework assignments are meant to strengthen your conceptual understanding in the course. They are not intended to be a masochistic ritual. I also recommend that you use my office hours properly and judiciously. If you have not had related material before this material takes a while to sink in. This is not a "easy" course and if you have not had exposure to these concepts before then I suggest you do extra problems from the references to strengthen your concepts.

Attendance Policy

It is assumed that the students are aware of and understand the university attendance policy. In any case if you do not attend class, I don't care, because you are assumed to be adults and it is your money or in some cases your parents money going down the drain.

Make-up Exam Policy

I do not give make-up exams. If you need to take the exam ahead of time then it is **your responsibility** to arrange a alternative date/time with me and this will be only under extraneous circumstances.

Cheating and Academic Honesty

It is also assumed that you are familiar with the university academic honesty policy. Needless to say that academic dishonesty will be dealt with seriously.

Prerequisites

I am assuming that you are familiar with the computing software, MATLAB. If you need some review or introduction I can direct you to reference material. I will also go through the review material from EECE-314 whenever needed. So if you feel that your knowledge of the EECE-314 material is inadequate then you should probably register for the course. I also have some notes from the EECE-314 course if you need a quick review of the material. Needless to say that it is the **responsibility of the student** to make sure that they have the prerequisite knowledge needed for the course.

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