ECE-340
Spring 2011
Probabilistic Methods in Engineering (3 credits)

M & W 4:00-5:15 PM; Room ECE-210

Syllabus

Course Goals: To introduce the student to basic theoretical concepts and computational tools in probability and statistics with emphasis on their role in solving engineering problems.

Course Catalog Description: Introduction to probability, random variables and random processes; probability distribution/density functions, expectation, correlation, power spectrum, WSS processes; confidence intervals; transmission through LTI systems; applications of probability.

Prerequisites: Math 314 (in addition, ECE 314 is highly recommended).

Textbook: Probabilistic Methods of Signal and System Analysis, G. R. Cooper and C. D. McGillem, 3rd edition, Oxford University Press, 1999.

Instructor: Prof. Majeed Hayat

Office:	ECE 323-B;
Office hours:	T: 2-3, W: 10-11, or by appointment; walk-in' are OK too.
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Course Requirements

1) Conduct

Students are expected to comply with the *Student Code of Conduct* found in the UNM Student Handbook. In particular, exchange of information during exams and quizzes is strictly prohibited.

2) Verbal and written communication

Oral and written communications are important in the educational setting. Each student is expected to participate in classroom discussions. Students are also expected to exhibit good writing when working homework assignments, quizzes and examinations.

3) Homework

Homework assignments will include problems from the text as well as special problems. Some problems may require the use of MATLAB, which is available in the ECE Computer labs. Computer-aided simulation and analysis (using MATLAB) of random phenomena will be an

integral part of the course for two reasons. Firstly, simulation of practical problems will motivate students and gives them a realistic and enjoyable feel to the concept of chance. Secondly, Monte-Carlo based methods are necessary for the simulation and analysis of certain problems that cannot be solved analytically. Completion of homework assignments is a key component of this course, as it will help students master the course material and prepare for the exams. Late submissions are generally not accepted unless under extreme conditions. Solutions will be provided when the assignments are graded and returned. **Homework assignments are due on Fridays anytime between noon and 1PM. The TA, Mr. Dirafzoon, will collect them in his office between noon and 1PM on Fridays.**

4) Examinations

There will be two required midterms and a final. Make-up exams are given *only* under extreme conditions (such as in a medical emergency with a written request from a doctor).

5) Quizzes

There will be a 5-minute quiz every Wednesday in the beginning of the class period (with the exception of the first week of class). Each quiz will be on the material covered in the two lectures before the quiz. The purpose is to encourage students to read the class notes and be in synch with the course.

6) Attendance

Attendance is mandatory. Missing more than two lectures requires the permission of the instructor.

7) Small-group project

Groups of 2-3 students will be required to work on a small project comprising experimentation (of a random phenomenon) and analysis of results. The specifics of the project will be announced approximately 8 weeks before the due date, which will be on the final class period. Each group will be asked to prepare a brief report. Tools learned in class should be used to complete the design. The use of Matlab will be required to complete the project.

8) Recitation sessions

There will be weekly recitation sessions on problem solving. Attendance is required. Day and time will be decided upon in the first class period. **Recitation sessions are scheduled for every Wednesday at 5:30; the duration of each session is 60 minutes and they will be held in Room ECE 118.**

Grading

10%	Completion of homework assignments
10%	Weekly 5-minute quizzes every Wednesday in the beginning of class
20%	First Exam, **Monday, Feb. 21**
20%	Second Exam, **Monday, Apr. 11**
30%	Final Exam: **Monday, May 9**, 5:30-7:30 PM, Room ECE-210
10%	Small-group project (details to be announced)

Tentative grade assignment:

90-100 (A);
80-89 (B);
70-79 (C);
60-69 (D);
59 or below (F).

Some important dates:

Last day to drop without a grade: Friday, Feb. 4,
Spring break: Mar. 13 – 20
Last class period for this course: May 4
Final examination: Monday, May 9, 5:30 PM – 7:30 PM

Outline of topics to be covered

Main topics and chapters	**Subtopics**
Introduction and some motivating examples Chapter 1: 1.1	Why do we need probabilistic analysis in science and engineering? Some motivating examples.
Fundamentals of probability Chapter 1: 1.2 – 1.11	Sample space, events, examples, axiomatic definition of probability, some combinatorics, the Binomial law, conditional probability and Bayes' rule, law of total probability, independence, random-number generation
Random variables Chapter 2: 2.1 – 2.9 and class notes	Meaning and significance of random variables, types of random variables, distribution functions, density functions, some important random variables, functions of a random variable, expectation, mean and moments, Chebychev's inequality.
Multiple random variables Chapter 3: 3.1 – 3.7	Bi-variate and multivariate distribution functions, density functions, independence, conditional density functions, expectations and conditional expectation, distribution of sums of independent random variables, transformations, covariance matrices, characteristic functions.
Elements of statistics and inference Chapter 4: 4.1- 4.5	Sample mean and sample variance, confidence intervals, hypothesis testing
Introduction to random processes Chapters 5-8: 5.1-5.4; 6.1-6.8; 7.1-7.2, 7.6-7.7; 8.1-8.3, 8.7	Definition and examples, wide-sense-stationarity, autocorrelation functions, white noise, power-spectral density, response of LTI systems to random signals.