CLEMSON UNIVERSITY

ECE 818: Random Process Applications in Engineering
Fall 2010
MWF 9:05-9:55am, 227 Riggs Hall
Prof. Carl Baum, Clemson University

Contact Information:
For Admistrative/Procedural Questions: Contact via email at ***baumc@clemson.edu***.
For Technical Questions on Course Content: Office hours are MWF 11:15am–noon at 304 Fluor Daniel. If a student has a course during this time, additional office hours can be made by appointment. During office hours, in-person visits and telephone calls at 864-656-5928 are welcome. Note that experience has shown that email is a terribly inefficient means of communicating mathematical and scientfic details. For this reason, *technical* questions about the course content will not be answered via email.

Course Objectives:
Upon completion of this course, students should be able to solve diverse problems using the tools of probability theory, random variables, and random processes. Students should also become familiar with the common characterizations and uses of random processes in engineering applications.

Course Prerequisites:
The prerequisite for ECE 818 is ECE 317 or its equivalent.

Course Materials:
Course notes, a draft copy of a textbook being written by the instructor, homework assignments, and other materials are available for download on Blackboard via ***bb.clemson.edu***. There is **no** required *purchased* textbook required for the course. An *optional* textbook is *Probability, Random Variables, and Stochastic Processes* by Papoulis, McGraw-Hill publishers. Note, however, that although the textbook and the course cover similar topics, the notation and the coverage is significantly different.

Grading:
Final grades will be determined by averaging the homework, exams, and the final exam based on the following scale:

Homework	10%	A	90% – 100%
2 Exams	40%	B	80% – 89%
Final Exam	50%	C	70% – 79%
		D	60% – 69%

The A/B/C/D grading scale may be adjusted depending on overall class performance (but only in your favor).

Homework:
There are 6 homework assignments, one per major section of the course. Homework is due in class at the beginning of class on dates announced in class (generally, the class after the lectures covering a section are completed). Absolutely no late homeworks are accepted, and alternate delivery techniques (email or under my office door) are also not accepted. Homework must be written in your own handwriting; copies are not accepted. Homework assignments are posted in Blackboard; solutions are also posted after the deadline for turning in the homework has passed.

Exams:
Midterm exams are 50 minutes long and contain 12-15 multiple-choice problems; the final is 150 minutes and contains 30-38 problems. *You must bring a Clemson OMR answer sheet (purple)*

to each exam. Do not purchase the sheets that come in rolls, but the ones that lie flat; with the rolls, your test might be misgraded. The first exam covers the first two sections of the course, and the second exam covers the next two sections. The final is cumulative. For the first exam you may bring 2 pages of notes; for the second exam, 4 pages; for the final, six. The idea here is to add one notes page for each section, bringing the notes pages from old sections along with the new pages to each test. No equations are provided on any exam. Midterm exam dates will be announced in class; the final exam is Friday, Dec. 10, at 8:00-10:30am.

Class Attendance:
Class attendance is not mandatory, but strongly encouraged. There are no makeups or alternate dates for midterms or the final except in truly exceptional circumstances (e.g., medical emergency). Class is cancelled if the professor is more than 15 minutes late. If homework was due on the date of a cancellation, it will instead be due at the following class. If a cancellation occurs on a test date, the test will be given in the following class.

Academic Integrity:
Anyone caught in an act of academic dishonesty (cheating) will be penalized to the maximum extent allowed by Clemson University Academic Regulations.

Disability Access:
It is University policy to provide, on a flexible and individualized basis, reasonable accommodations to students who have disabilities. Students are encouraged to contact Student Disability Services to discuss their individual needs for accommodation, obtain a letter if appropriate, and then to discuss those needs with the instructor. In order to obtain accommodations, the student must notify the instructor no later than the end of the first week of class.

Summary Topical Outline:

1. Probability and Random Variables (2 weeks)
   Probability spaces, conditional probability and independence, random variables, functions of random variables, expectation, moment generating functions, conditional distributions and conditional expectation.
2. Random Vectors (2 weeks)
   Random vectors, independence, functions of random vectors, expectation, covariance and correlation matrices, moment generating functions, complex random variables, conditional distributions and conditional expectation.
3. Random Signals (3 weeks)
   m-th order distribution and density functions, mean, correlation, and covariance functions, independent and uncorrelated component processes, independent and uncorrelated increment processes, multiple random signals and complex random signals, sum signals and integral signals, difference signals and derivative signals, binomial processes, Poisson processes, Gaussian white noise and Wiener processes.
4. Properties of Random Signals (3 weeks)
   Periodicity, stationarity and spectral densities, cyclostationarity, convergence, law of large numbers, central limit theorem, stochastic continuity, energy and power signals, time averages and ergodicity, memory and the Markov property
5. Systems with Random Signals (3 weeks)
   Stochastic response to linear and time-invariant systems, systems and stationarity, filtering of random processes, stochastic Fourier series, Karhunen-Loeve expansion
6. Markovian Systems (2 weeks)
   Discrete-time Markov chains, continuous-time Markov chains, sstate classification, ergodic chains, steady-state behavior, mean first passage times, mean recrurrence times.