EE 302 - Signals and Systems II - 3 hours
Required Course

1. *2007-2008 Catalog description*
   Sampling theorem, digital filters, probability theory, statistics, random variables, probability density functions, auto- and cross-correlation functions, power spectral density of random processes, analysis of linear time invariant systems with random inputs in time domain and in frequency domain, simulation of random experiments.
   Prerequisite: EE 301.

2. *Prerequisites by topic*
   a Basic system theory linearity, time invariance, causality.
   b Time-domain analysis: convolution integral, Fourier series analysis.
   c Frequency-domain analysis: Fourier transform, Laplace transform, Z transform.
   d Basic digital filter design.

3. *Textbook (s) and/or other required material*
   Required: "Signals and Systems: Continuous and Discrete," Fourth Edition, by Rodger E. Ziemer, William H. Tranter, and D. Ronald Fanin, Prentice-Hall, 1998.
   Required: "Probabilistic Methods of Signal and System Analysis," Third Edition, by George R. Cooper and Clare D. McGillem, Oxford University Press, 1999.

4. *Class/Laboratory Schedule*
   Three class sessions per week, each 50 minutes, for 14 weeks

5. *Topics Covered (Outcomes influenced)*
   - FIR and IIR filter design and implementation (7a, 7b, 7c)
   - Probability axioms (7d)
   - Statistical independence, mutual exclusiveness, marginal and joint probabilities, conditional probability (7e)
   - Probability distributions: Gaussian, Rayleigh, uniform, delta (7e)
   - Joint probability density functions: correlation, covariance, correlation coefficient, sum of two independent random variables (7e, 7f)
   - Statistical estimate of random parameters; sample mean, sample variance and covariance (7f)
   - Sampling distributions and confidence intervals (7f)
   - Various descriptions of random processes: ergotic, wide sense stationarity (7g)
   - Autocorrelation and cross correlation functions (7h, 7i)
   - Power spectral densities of random process (7i)
   - Responses of linear time invariant systems to random inputs (7j)
   - Simulation techniques using MATLAB software (7k)
   - Grading policy and ECE Code of Conduct (7l)

6. *Contribution of course to meeting the curriculum components*
   Engineering Science - 50%, Engineering Design - 50%

7. *Course Outcomes (Program Outcome contributions): In learning the course topics, the student will attain the following outcomes*
   a The student will apply the sampling theorem (9B)
   b The student will design and implement both IIR and FIR digital filters (9B)
   c The student will analyze the design of a digital filter using Matlab (9B, 9C)
   d The student will use the axioms of probability to construct probability relations (9A)
   e The student will describe single and multiple random variables using the probability density functions and the probability distribution function (9A)
   f The student will analyze statistical data and find sampling mean, sample variance, and confidence interval (9A)
   g The student will measure and compute analytically the auto- and cross-correlation functions (9B, 9C)

h The student will estimate information including statistical bounds on the size of the signal from the correlation function (9B, 9C)
i The student will apply the power spectral density to determine the critical frequencies of random processes (9B, 9C)
j The student will describe the response of a linear time invariant systems to random inputs in time domain and in frequency domain (9B, 9C, 9D)
k Using Matlab the student will simulate random experiments (9B, 9C)
l The student will understand the ECE Code of Conduct (9G)

8. *Grading policy and criteria:*

There will be four exams worth seventy-five points each and a final worth one hundred and fifty points. Special homework assignments involving simulation will be collected and will count up to fifty points in determining the final grade. An estimate of the letter grade for every two exams will be given when the exam is returned; however, the final grade will be determined by the combined numerical results of all tests. All exams will be closed book. No notes, calculators, or cell phones will be permitted. Exams may include Matlab examples for interpretation. A grade of C corresponds to meeting the minimum competency required to understand course topics and meet course objectives.
Warning**:** An unexcused absence from a scheduled exam will earn you a zero for that exam. In addition, cheating will be dealt with as described in the *Academic Handbook.* The ECE Faculty has established the ECE Student Code of Conduct based on well known requirements of academic integrity as well as the ethical and professional conduct expected of an engineer. The ECE student code is attached to this document and also appears on Blackboard.

9. *Relationship of course to program outcomes*

Label	Program Outcomes (A Graduate from the program will:)	Contribution
A	have knowledge of the mathematical and scientific foundation of electrical engineering	Strong
B	have knowledge of and the ability to apply techniques and technology of electrical engineering	Strong
C	complete a design project sequence, culminating in a capstone project at or near the professional level	Foundational
D	understand that acquisition of new knowledge is needed for success in the electrical engineering profession	Strong
E	meet Bradley's general education requirements which are based on the principles of liberal education	NA
F	have experience in communicating technical information and working on teams	Foundational
G	understand the importance of professional and ethical behavior	Moderate

10. *Prepared by*: Thomas L. Stewart, July 25, 2008.