ECE 5510: Random Processes

Credits and Contact Hours: 3.0 Credit Hours
15 weeks: Two 80-minute lectures per week

Instructor’s Name: Rong-Rong Chen

Text Book(s) and/or Required Material:

Catalog Description: Review of probability theory; multivariate distributions; Gaussian distributions; Poisson process, Brownian motion, stationary random processes, mean-value function; auto- and cross-correlation functions; power spectral densities; random processes in linear filters; white Gaussian noise; Markov Chains.

Prerequisites: C- or better in:
- ECE 3500: Fundamentals of Signals and Systems; and
- ECE 3530: Engineering Probability and Statistics; and
- Full major status in Computer Engineering

Designation: Selected Elective

Contribution of Course to Meeting the Requirements of ABET Criterion 5: Engineering sciences and engineering design: Material in this course is necessary for further study and analysis in communication systems, signal processing, and controls.

Specific Outcomes of Instruction: In this course, students will be prepared to:
1. Understand basic concepts in probability including basic axioms of probability, conditional probability, independence, the law of total probability, Bayes rule.
2. Build and analyze probability models in both the discrete and continuous context.
3. Study fundamental concepts in random processes including stationarity, power spectral density, and random processes through linear time-invariant systems.
4. Study Poisson, Bernoulli, Gaussian, and Markov random processes.
5. Develop the ability to analyze random processes in practical engineering applications.

Relationship of the Course to the Program Outcomes:
(a) An ability to apply knowledge of mathematics, science, and engineering. Students apply fundamental concepts, including probability, linear systems, and computer simulation. Students apply this background knowledge and material learned in the course especially when solving homework problems.

(b) An ability to design and conduct experiments, as well as to analyze and interpret data, and to debug and analyze software. Students use Matlab to simulate random processes and then analyze the simulation data to match theoretical values.
(e) An ability to identify, formulate, and solve engineering problems. In some of the homework assignments, the students must identify problems encountered and develop solutions for them.

(k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Students use Matlab as an analysis and simulation tool during the semester.

**Topics Covered in the Course:**
- Getting Started with Probability
- Discrete Random Variables
- Continuous Random Variables
- Pairs of Random Variables
- Random Vectors
- Sums of Random Variables
- Poisson Random Processes
- Brownian Motion
- Random Processes through Linear Systems
- Application of Random Processes to Wireless Communications
- Markov Chains