EEL4930 - Random Signal Principles

Three Credits, Four hours, Engineering Topic.

Instructor: Dr. Vladimir Pozdin.

Textbook: Dimitri P. Bertsekas and John N. Tsitsiklis, "Introduction to Probability, 2nd Edition" ISBN: 978-1-886529-23-6, Jul. 2008. Additional resources:

1."Introduction to Probability" course on MIT OpenCourseWare taught by Prof. John Tsitsiklis (textbook author).

2.A. Papoulis and S. U. Pillai, "Probability, Random Variables and Stochastic Processes**,"** 4th Edition.

3.Robert G. Gallager, "Stochastic Processes: Theory for Applications," ISBN: 978-1107039759.

4.Roy D. Yates and David J. Goodman, "Probability and Stochastic Processes," ISBN: 978-1118324561.

5.Matlab will be a useful tool for some of the course assignments and is provided free to FIU students (labs, download, mobile, or online). MathWorks.

Specific Course Information:

The probability theory (random signal principles) is a very useful tool in analyzing and designing applications across multiple fields such as engineering, science, and management. In this course, first the students will be taught the fundamentals of probability theory (probabilistic models, conditioning, independence, discrete and continuous random variables, and multiple random variables). Second, the students will be taught random processes (e.g. Bernoulli and Poisson processes). As time permits, we will also discuss Markov chains and limit theorems. Finally, as these concepts are being introduced throughout the course, students will be learning about noise, correlation, spectral analysis in the analysis and design of communication systems, optimization techniques, and minimum mean square error.

Specific Goals for the Course

a. Specific outcomes of instruction

Upon successful completion of this course, the student will:

Upon the completion of the course, students should be able to identify and characterize processes with common random variables. Students should be able to find the expectation value and variances of derived random variables to describe common engineering processes. In addition, students should be able to analyze noise, correlation, spectral analysis in a design of a communication system. Optimization techniques and minimum mean square error will also be covered.

b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

In this course the student will have to show

(a) an ability to apply knowledge of mathematics, science, and engineering (N/A)

(b) an ability to design and conduct experiments (simulations), as well as to analyze, interpret data (N/A)

(c) an ability to design a system, component, or process to meet desired needs (N/A)

(d) an ability to function in multi-disciplinary teams (N/A)

(e) an ability to identify, formulate, and solve engineering problems (homework) (N/A)
(f) an understanding of professional and ethical responsibility (N/A)
(g) an ability to communicate effectively (through project reports) (N/A)
(h) the broad education necessary to understand the impact of engineering solutions in a global and societal context (N/A)
(i) a recognition of the need, and an ability to engage in life-long learning (N/A)
(j) a knowledge of contemporary issues (N/A)
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (N/A)
(l) a knowledge of probability and statistics (N/A)

Brief list of the topics to be covered

1. Set theory and probability models
2. Conditional probability and Baye's rule
3. Discrete random variables
4. Functions of discrete random variables
5. Continuous random variables
6. Gaussian random variables
7. Derived random variables
8. Sums of random variables and Gaussian processes
9. Bernoulli processes
10. Poisson processes and Markov chains
11. Limit theory and inference

GRADING:

Course Requirements	Weight
Participation	5%
Homework	30%
Midterm Exam	30%
Final Exam	35%
Overall Grade	100%

Conversion of Numerical Grade to Letter Grad

95<= A <=100	83<= B< 86	70<= C < 76
90<= A- < 94	80<= B-< 82	60 <= D < 69
87 <= B+ < 89	77 <= C+ < 79	F: Below 60