EE - 3180
Introduction to Probability and Random Signal Analysis

Curricular Designation: EE: required  CpE: elective

Catalog Description:
EE 3180 – Introduction to Probability and Random Signal Analysis Probability density and distribution functions, expected values and correlation. Wide sense stationary random signals. The correlation function and spectral density. Random signals and noise in linear systems. Engineering applications. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Spring Summer Restrictions: Must be enrolled in one of the following Major(s): Computer Engineering, Electrical Engineering Pre-requisites: EE 3160

Textbooks(s) and/or Other Required Materials:

Prerequisites by Topic:
1. Differential and integral calculus
2. Differential equations
3. The Fourier transforms
4. The inverse Fourier transform
5. Convolution

Course Objectives:
1. This course provides the student with an understanding of probability, random variables, density functions, and distribution functions
2. This course provides the student with an understanding of means and moments
3. This course provides the student with an understanding of correlation and statistical independence
4. This course provides the student with introduction to hypothesis testing and engineering applications
5. This course provides the student with introduction to statistics and parameter estimation
6. This course provides the student with introduction to the application of probability to engineering problems
7. This course provides the student with an introduction to random processes (signals)
8. This course provides the student with an introduction to the correlation function, the spectral density, and white noise
9. This course provides the student with introduction to the application of random signal analysis to engineering problems

Topics Covered:
1. Probability and random experiments
2. Conditional probability and independence
3. Introduction to discrete and continuous random variables, probability mass functions and densities
4. Functions of a random variable  
5. Mean values and moments  
6. Gaussian random variables and other probability density functions  
7. Pairs of random variables  
9. Conditional probability, correlation, and statistical independence  
10. Introduction to hypothesis testing  
11. Random processes (signals) and properties  
12. The autocorrelation function and the spectral density  
13. White noise  
14. Response of linear systems with random inputs  

**Relationship of the Course Content to Program Outcomes:**

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<tr>
<th>Topics and Level of Coverage</th>
<th>Outcome</th>
<th>Important</th>
<th>Moderately</th>
<th>Minimally</th>
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<td>Important</td>
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<td>a an ability to apply knowledge of mathematics, science and engineering</td>
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<td>b an ability to design and conduct experiments, as well as to analyze and interpret data</td>
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<td>c an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, health and safety, manufacturability and sustainability</td>
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<td>d an ability to function on multi-disciplinary teams</td>
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<td>e an ability to identify, formulate and solve engineering problems</td>
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<td>f an understanding of professional and ethical responsibility</td>
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<td>g an ability to communicate effectively</td>
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<td>h the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context</td>
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<td>i a recognition of the need for, and an ability to engage in life-long learning</td>
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<td>j a knowledge of contemporary issues</td>
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<td>k the ability to use the techniques, skills, and modern engineering tools necessary for the practice of electrical engineering</td>
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**Contribution of Course to Meeting Degree Requirements:**

2 Credit Hours – Math/Basic Science  
1 Credit Hour – Engineering Topics  

**Class/Laboratory Schedule** (note: 1 hour = 50 minutes):  
Lecture: 42 hours = 3 hours/week for 14 weeks  

**Prepared by:**  
Timothy Schulz, Professor, December 4, 2016