EE 345

1. **Course Number & Name:** EE 345, Probability and Statistics for Engineers
2. **Course Credit and Contact Hours:** 3 Units, 3 hours
3. **Course Coordinator:** Nansong Wu, Ph.D.
4. **Textbook:** Statistics for Engineers and Scientists, by William Navidi, 5th edition, 2019, McGraw-Hill Education, ISBN-13: 978-1259717604.
5. **Supplemental Materials:**
6. **Specific Course Information:**
   a. **Description:** Probability and it axioms, conditional probability, sequential experiments, independence, counting, discrete, continuous & mixed random variables & distributions, functions of random variables, expectations, multiple random variables joint distributions, central limit theorem, weak law of large numbers, estimation of random variables, random processes and their characterization.
   b. **Prerequisites:** MATH 241, or consent of instructor.
   c. **Co-Requisite:** None
   d. **Status:** ☑ Required for EE program, ☐ Elective, ☐ Selected Elective
7. **Specific Goals for the Course:**
   a. **Specific outcomes of instruction:** Upon successful completion of this course the students will be able to:
      i. Understand the concepts of discrete probability, conditional probability, independence, and be able to apply these concepts to engineering problems.
      ii. Understand the mathematical descriptions of random variables including probability mass functions (PMF), cumulative distribution functions (CDF), probability distribution functions (PDF), and associated conditional PMF, CDF and PDF functions.
      iii. Be familiar with the more the commonly used random variables (such as the Gaussian random variable, Poisson random variable and others).
      iv. Be able to calculate the various moments of random variables such as mean values, variances and standard deviations (and higher order moments).

v. Be able to mathematically characterize multiple random variables using joint PMFs, CDFs and PDFs.

vi. Be able to apply the concepts of multiple random variables to select engineering applications.

vii. Understand the law of large numbers, the central limit theorem and how these concepts apply to engineering applications.

viii. Use statistical concepts to analyze and interpret engineering data.

b. This course supports the following ABET Student Outcomes:

i. SO-1: an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

8. Brief List of Topics to be Covered:

a. Set theory, set operations, Venn diagrams and tree branching
b. Concept of a function, random experiments and probabilities
c. Axioms of probability, independence, De Morgan's laws, Bayes' rule
d. Discrete and continuous probability models
e. Combinatorics and counting, ordered and unordered sampling
f. Bernoulli trials, binomial distribution, geometric distribution and Poisson distribution
g. Expectation and variance, higher order moments
h. Probability mass functions, probability density functions and cumulative distributions
i. Continuous random variables – uniform, Gaussian and Rayleigh distributions
j. More than one random variable – joint distributions
k. Covariance and correlation coefficients
l. Statistical inference and Maximum Likelihood Estimation
m. Central limit theorem, law of large numbers
n. Examples of random variables – noise in electrical circuits and communication systems