EEE 4541 Stochastic Processes and Random Signals

Credits: 3

Text book, title, author, and year: P. Z. Peebles, *Random Variables and Random Signal Principles*: McGraw-Hill, Inc.,2001 and S. Ross, *A First Course in Probability*, Prentice –Hall, 10th Edition

Supplemental materials: Hand-outs: Notes by the Instructor

Specific course information

a. **Catalog description:** Introduction to probability and random processes. Response of linear systems to stochastic inputs. Distribution functions, power spectra, correlation functions, noise theory. Detection of electrical signal in the presence of noise. Applications of radar, radio signal fading, etc.
b. **Prerequisites or Corequisites:** EEL 4512
c. **Required, elective, or selected elective:** selected elective

Specific goals for the course

a. **Specific outcomes of instruction:** By the end of the course students will be able to: (i) Understand the basic aspects of statistics, probability and random processes; (ii) Understand the use of statistics, probability and random processes in engineering; (iii) Understand the use of statistics, probability and random processes in communications, control etc. (iv) Use relevant computational skills.

Brief list of topics to be covered:

UNIT I

- Statistics and statistical methods of analyses in engineering: Definition and calculation of statistical parameters, such as mean, variance, correlation and their applications.
- Statistical principles and probability concepts: The sample space, random events, probability, conditional probability, independence, and their applications.
- Basic concepts of random variable: Probability density function, conditional probability density function and their applications. n^{th}-order distributions and their applications.

UNIT II

- Introduction to stochastical theory and concept of random processes; sample functions.
- Stationary and non-stationary processes; wide-sense stationary process; concept of ergodicity. Correlation (auto and cross) functions and power density spectrum. Relevant applications in the analysis and design of linear time-invariant systems – system response to random signals

UNIT III

- Characterization of noise; types of noise; detection of signal in the presence of noise
- optimal filtering: Communication and radar signals