# EE:502

# Modeling of Stochastic Engineering Systems

# Department of Electrical Engineering

# King Saud University

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**Course Material: Will be provided through LMS system**

**Lecture Schedule and Location:**

**Textbook: Alberto Leon-Garcia, Probability, Statistics, and Random Processes for Electrical Engineering, Prentice Hall, 3rd Edition, 2008.**

**References:** A. Papoulis and S. Pillai, Probability, Random Variables, and Stochastic Processes, McGraw-Hill, New York, 4th Edition, 2002.

P. Peebles, Probability, Random Variables, and Random Signal Principles, McGraw-Hill, New York, 4th Edition, 2001.

Probability and Random Process with Applications to Signal Processing, Henry Stark and John W. Woods , Third Edition, Pearson Education, 2002

**Course Objectives:** The main objectives of this course are to introduce students to the advance concepts of probability theory and random processes that are required to understand probability and stochastic models used in electrical and computer engineering, and to present some of the techniques that are needed to develop probability and stochastic models.

**Evaluation:** The grading system applied in this course is as follows:

60% Mid Exam/HW/Quiz

40% Final Exam

**Pre-requisite: Probability Models, Probability and Axioms of Probability** (Chapter#1,2)

Probability Models, Definition of Probability, Set Theory, Probability Space, Axioms of Probability, Conditional Probability, Total Probability, Baye's Theorem , Sequential Experiments

**LectureSlides#0, Chapter#1 : 1.1 , 1.2 , 1.3 , 1.4, 1.5 Chapter#2: 2.1 , 2.2 , 2.4 , 2.5 , 2.6**

**Course Outline**

**Discrete Random Variables**: **(Chapter#3, LectrureSlide#1), Mid Exam, Final Exam**
3.1 The Notion of Random Variables
3.2 Discrete Random Variables and Probability Mass Function
3.3 Expected Value and Moments of Discrete Random Variable
3.4 Conditional Probability Mass Function
3.5 Important Discrete Random Variables

**One Random Variable**: (**Chapter#4, LectureSlide#2)** , **Mid Exam, Final Exam**
4.1 The Cumulative Distribution Function (CDF)
4.2 The Probability Density Function (pdf)
4.3 The Expected Value of X
4.4 Important Continuous Random Variables
4.5 Functions of Random Variables

**Pairs of Random Variables: (Chapter#5, LectureSlides#3), Mid Exam Final Exam**
5.1 Two Random Variables
5.2 Pairs of Discrete Random Variables
5.3 The cdf of X and Y
5.4 The joint pdf of Two Continuous Random Variables
5.5 Independence of Two Random Variables
5.6 Joint Moments and Expected Values of a Function of Two Random Variables
5.7 Conditional Probability (Only)
5.8 Function of Two Random Variables

**Vector Random Variables: (Chapter#6, LectureSlides#4), Final Exam**
6.1 Vector Random Variables
6.2 Functions of Several Random Variables
6.3 Expected Values of Vector Random Variables
6.4 Jointly Gaussian Random Vectors
6.5 Estimation of Random Variables

**Random Process: (Chapter#9, LectureSlides#5,#6), Final Exam**
9.1 Definition of a Random Process
9.2 Specifying a Random Process
9.3 Discrete-Time Processes (9.3, 9.3.1, 9.3.2, 9.3.3)
9.5.1 Gaussian Random process
9.6 Stationary Random Process (Wide-Sense-Stationary (WSS))

**Analysis and Processing of Random Signals: (Chapter#10, LectureSlides#7), Final Exam**
10.1 Power Spectral Density(Continuous-Time)
10.2 Response of Linear Systems to Random Signals (Continuous-Time)