ELEC2600H Honors Probability and Random Processes in Engineering

Course Description

This course is an accelerated and intensive course on probability and random processes. There will be an introduction to random processes in electrical engineering, including the necessary probabilistic background. The course also covers random variables, distribution and density functions, characteristic functions, conditional distributions, expectation, moments, laws of large numbers, central limit theorems, and stochastic processes. Advanced applications of engineering research will also be introduced.
Exclusion(s): ELEC 2600, MATH 2421 *Prerequisite(s):* Grade A- or above in MATH 1014 OR MATH 1020 OR MATH 1024 *Corequisite(s): MATH 2011 OR MATH 2023*

List of Topics

Lecture 1: Course Introduction, Probability Models
Lecture 2: Build a Probability Model, Axioms and Corollaries
[Out-of-Class Reading: Set Operations]
Lecture 3: Conditional Probability, Independence
Lecture 4: Sequential Experiments
Lecture 5: Discrete Random Variables, Probability Mass Function
Lecture 6: Expected Value and Moments; Important Discrete Random Variables
[Out-of-Class Reading: Conditional PMF and Expectation]
Lecture 7: Continuous Random Variables, CDF and PDF
Lecture 8: Expected Value and Moments of Continuous RVs; Important Continuous RVs
Lecture 9: Function of a Random Variable
Lecture 10: Pairs of Discrete RVs.
[Out-of-Class Reading: 2D Calculus]
Lecture 11: Pairs of Continuous RV's
Lecture 12: Independence; Joint Moments
Lecture 13: Correlation Coefficients and Properties
Lecture 14: Conditional PDF, Conditional Expectation
Lecture 15: Sum of Two RV's
Lecture 16: Pairs of Jointly Gaussian RV's
Lecture 17: More than Two Random Variables
Lecture 18: Laws of Large Numbers
Lecture 19: Central Limit Theorem
Lecture 20: Covariance Estimation and Application (research topic)
Lecture 21: Definition of a Random Process
Lecture 22: Sum Processes and Independent Stationary Increment Processes
Lecture 23: Mean and Autocorrelation of Random Process
Lecture 24: Stationary Random Processes
Lecture 25: Ergodic Process

Statement of Objectives/Outcomes:

On successful completion of this course, students will be able to:

CO1 - understand the mathematic basis of probability models and their application to engineering

CO2 - manipulate probability models to solve engineering problems

CO3 - manipulate probability models, including using complex technical arguments and theoretical proofs, to solve engineering problems

CO4 - use software tools to manipulate, process, analyze and plot quantities relating to engineering probability models

CO5 - understand the use of probability models in engineering research

Textbook(s):

A. Leon-Garcia, *Probability and Random Processes for Electrical Engineering*, Addison-Wesley, 3rd ed., 2009

Reference Books/Materials:

P. Z. Jr. Peebles, *Probability, Random Variables and Random Processes*, 4th ed., Mc-Graw Hill, 2001

P. G. Brown and P. Y. C. Hwang, *Introduction to Random Signals and Applied Kalman Filtering*,3rd ed., New York: John Wiley & Sons, 1997

G.R. Grimmet and D.R. Strizaker, *Probability and Random Processes*, 2nd ed., Oxford Science Publishers, 1992

A. Papouils, *Probability, Random Variables and Stochastic Processes*, 3rd ed., Mc-Graw Hill, 1991

H. Stark and J. W. Woods, *Probability, Random Processes and Estimation Theory for Engineers*, 2nd ed., Prentice Hall, 1994

Relationship of Course to Program Outcomes:

Please refer to the Report Section 4.3.2 (iii).

Grading Scheme:

Homework	8%
Quiz	50%
Final Examination	40%
Attendance	2%