ECE 303: Introduction to Communication Principles

IN

OUT

Sequences and Series

- Understand convergence of sequences and series
- Know series and sequence representations for $\exp(x)$
- Evaluate finite and infinite geometric sums.
- Know basic linear algebra

Differentiation

- Compute partial and total derivatives
- Know chain rule
- Know and can apply Liebnitz rule

Integration

- Integrate by parts
- Compute definite 1D and 2D integrals

Pre-requisites

- MATH261 with a C or higher; MATH340, may be taken concurrently

Concepts:

- Sample space, outcomes, events
- Probability measure
- Games and counting formulas
- Conditional probability, total probability, and Bayes' rule
- Discrete, continuous, and mixed random variables
- CDF, PMF, and PDF
- Mean, conditional mean, moments and their uses
- Classical distributions and their origins
- Multiple random variables
- Joint, marginal, and conditional CDF/PDF
- Covariance, correlation, independence
- Functions of random variables
- Moment generating function, characteristic function
- Independent and identically distributed (iid) random variables
- Central limit theorem
- Law of large numbers
- Linear transformation of random variables
- Sums of iid random variables,
- Estimation and confidence intervals
- Stochastic Processes
- Binary communication and error probability
- Simulations

Applications:

- Biomedical Engineering
- Communications
- Control and Robotics
- Finance
- Lasers and Optics
- Microelectronics and Semiconductor Processing
- Radar and Remote Sensing
- Reliability and Operations Research
- Signal/Image Processing

Tools:

- MATLAB Programs and Simulations

Experiments and Probability Spaces

- Specify probability space and probability measure for an experiment
- Understand independence and conditional probability
- Apply Bayes Rule and Law of Total Probability

Random Variables

- Computes PMF, PDF, CDF, moment generating functions, and moments
- Computes PDF for functions of random variables

Probability Distributions

- Understand Bernoulli, binomial, geometric, Pascal distributions
- Understand exponential, Erlang, Gaussian and uniform distributions

Binary Communication

- Use standard Gaussian tables
- Compute error probability for binary communication

Averaging and Estimation

- Use Chebyshev's inequality to design averages to meet specifications
- Understand Weak Law of Large Numbers and Central Limit Theorem

Simulations

- Simulates samples and construct histograms.
- Generates arbitrarily distributed random variables