Course Information

- Instructor: Dr. Namrata Vaswani, **Email:** namrata AT iastate.edu **Office:** 3121 Coover Hall
- Class webpage: http://www.ece.iastate.edu/ namrata/EE322/
- **Textbook:** Bertsekas & Tsitiklis, Introduction to Probability, Athena Scientific, 2002. (BT)
- **Handouts DO NOT replace the book. In most cases, they only provide a guideline on topics and an intuitive feel. The math details will be covered in class, so it is important to attend class and also you MUST read the book.**
- **Grading policy (tentative):**
  - Homeworks & Quizzes: 30%
  - Two Midterm Exams: 15% each
  - Final Exam: 40%
- *Disability accommodation: If you have a documented disability and anticipate needing accommodations in this course, please make arrangements to meet with me soon. You will need to provide documentation of your disability to Disability Resources (DR) office, located on the main floor of the Student Services Building, Room 1076, 515-294-7220.*
- **Prerequisites:** EE 224, basic calculus, linear algebra
- Topics with **: will not be directly tested in quizzes or exams, but may be of use in understanding future topics. Will specify.

Class Outline (Syllabus)

- Introduction: Sections 1.1-1.6. **5 classes**
  - What is Probability
  - Set Theory Basics
  - Probability Models
  - Conditional Probability
  - Total Probability and Bayes Rule
  - Independence
  - Counting
- Single Random Variable: Sections 2.1-2.4, 3.1-3.3. **2 + 3 classes**
  - Chap 2, 2.1 - 2.4 and Chap 3, 3.1 - 3.3
  - What is a random variable?
  - Discrete random variable (r.v.)
    - Probability Mass Function (pmf)
    - pmf of Bernoulli, Binomial, Geometric, Poisson
    - pmf of $Y = g(X)$
    - Mean and Variance, Computing for Bernoulli, Poisson
  - Continuous random variable
    - Probability Density Function (pdf) and connection with pmf
    - Mean and Variance
    - Uniform and exponential random variables
  - Cumulative Distribution Function (cdf)
    - Relation with pdf and pmf
    - Connection between Geometric and Exponential **
    - Connection between Binomial and Poisson **
  - Gaussian (or Normal) random variable
- Multiple random variables: Sections 2.5-2.7, 3.4-3.6, 4.1-4.5. **2 + 8 + 3 classes**
  - Joint and Marginal pmf
  - Computing $E[g(X, Y)]$
  - Joint pdf and its interpretation, Marginal pdf, Joint cdf
  - Conditioning (both discrete and continuous r.v.s)
    - On an event (learnt in Chapter 1)
    - On a discrete r.v.
    - On a continuous r.v. and interpretation of conditional pdf
    - Conditional expectation and total expectation theorem
  - Independence
    - Discrete r.v.'s: same as independence of events

    - Continuous r.v.'s
    - Variance of sum of independent r.v.'s and applications
  - Inference and Bayes rule
  - Derived distributions (continuous r.v.'s)
    - pdf of $Y = g(X)$
    - Linear case $g(X) = aX + b$
    - Strictly monotonic case: $g(X)$ strictly increasing or decreasing
    - Functions of two r.v.'s, e.g. $Z = \max(X, Y)$
  - Moment generating function and pdf of sum of independent r.v.'s
  - Sum of random number of independent r.v.'s
  - Conditional variance identity

- Random Processes: just the basic idea, will not be tested. **2 classes**
  - Deterministic and Non-deterministic Random processes
  - Stationarity concept
  - Ergodicity concept
  - Correlation functions & Power Spectral Density
- Monte Carlo Sampling: just the basic idea, will not be tested **1 class**
- Discrete Markov Chains: (6.1-6.3): if time permits **2 classes**